AUTOMOTIVE and Uviation INDUSTRIES

JULY 1, 1944



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NOTHING ROLLS LIKE A BALL





NOTHING ROLLS LIKE A BALL



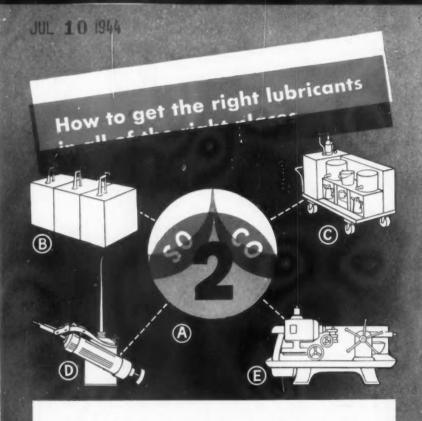
NOTHING ROLLS LIKE A BALL

Nothing Rolls Like a Ball

NEW DEPARTURE

BALL BEARINGS

NEW DEPARTURE, DIVISION OF GENERAL MOTORS
BRISTOL, CONNECTICUT



- **A.** A code number is assigned to each lubricant used in the plant and a bright numbered decal like that above is applied to every container and lubrication point.
- **B.** Each storage container has one of these numbered decals on it to indicate the lubricant it holds.
- C. Every container on the lubrication cart is marked with a numbered decal.
- **D.** Every oil can or grease gun is identified by a decal and filled from the cart or storage container with that numbered lubricant.
- E. Every spot to be lubricated on each machine is marked with the code number of the lubricant required.

Standard Coded Lubrication Service

... helps your oilers put lubricants where they belong

YOU HAVE spent much time and effort determining just which grease or oil is the best for each type of service in your plant. Haven't you wondered at times whether the thousand and one spots to be lubricated *always* get the *right* lubricant?

We have developed a simple method that will relieve you of that worry. It's Standard Coded Lubrication Service. The diagram above briefly explains how the system works.

The only record you need to keep is a lubrication chart listing the lubricants used in your plant, and the code numbers assigned to them. These numbers have no significance outside of your plant. You order lubricants by brand name just as you do now, but apply them by number.

TLI A6

Standard Coded Lubrication Service offers these advantages:

Prevents breakdowns resulting from the application of the wrong lubricant.

Simplifies training and instructing new oiler crews.

Saves oiler time by eliminating the need for looking up lubrication recommendations for individual machines.

Fits any lubrication program.

Simplifies lubrication requirements.

Avoids confusion of brand names.

Any of the advantages above is ample reason for calling your Standard Oil Industrial Representative for further information. Discuss it with the men in charge of your lubrication. For the Industrial Representative nearest you, or further information, call your local Standard Oil Company (Indiana) office, or write 910 South Michigan Avenue, Chicago 80, Illinois. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

Gasoline Powers the Attack . . . Don't Waste a Drop!

STANDARD OIL COMPANY (INDIANA)



...driving down 7,000 feet (4½-inch drill pipe)

ANOTHER COTTA "ENGINEERED-TO-ORDER" TRANSMISSION FOR INTERNATIONAL DERRICK AND EQUIPMENT CO., BEAUMONT, TEXAS

You know the terrific strain that's put on an oil-well drilling rig! Ideco's M-200-LG mechanical rig (above) is built to withstand heavy punishment, constant vibration . . . a gruelling grind in which a COTTA heavy-duty transmission plays a crucial part. Four speeds forward, one reverse . . . providing rugged, dependable transmission of power for the toughest jobs! For over 30 years COTTA has been a source of custom-designed transmission units for locomotive cranes, Diesel locomotives, power excavators, mine sweepers and the like. If you

have a job with exacting space limitations, one which an ordinary gear-box can't handle, send for our illustrated brochure on special transmission applications . . . free on request.





NICKEL AIDS THE COMMUNICATIONS INDUSTRY

to KEEP 'EM IN TOUCH!

In the tradition of Morse and Bell and Marconi, the communications engineer carries on today.

Hiswork, always valuable, now is vital.

No military campaign proceeds without it. The close teamwork between air, ground, and sea arms is possible only through instruments and equipment that keep them in touch though scattered throughout the four quarters of the globe.

And the vastly increased pace of modern war production brings with it increased use of every home-front circuit, line and wave-length.

All branches of the communications industry ... telephone, telegraph, radio ... are meeting the tremendous demand for their products. In war, communication engineers are taking advantage of their long peacetime experience with metals and alloys.

Time and time again this experience has shown them that a little Nickel goes a long way in improving other metals.

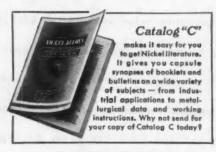
So now, when the dependability of what this industry makes is of supreme importance to the Nation, it favors more than ever the use of Nickel.

In repeaters, relays, magnetos, loading coils, transformers, loud-speakers and modern cables...even in the molds that form plastic radio parts...they call upon Nickel and its alloys for several unique advantages.

When other metals lack toughness, Nickel often supplies it. When they lack strength and fatigue resistance or corrode too easily, adding Nickel provides the needed qualities. Under abrasion, wear, shock and stress metals perform better with Nickel than without.

In the communications industry, as in many another, the knowledge, experi-

ence and cooperation of our staff has been at the disposal of technical men. Whatever your industry may be...if you want help in the selection, fabrication, and heat treatment of alloys... similar counsel and data are at your service.



* Nickel *

THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall St., New York 5, N. Y.

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Official U. S. Navy Photo

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The services of a Texaco Engineer specializing in cutting coolants are available to you through more than 2300 Texaco distributing points in the 48 States. The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXACO

More locomotives and railroad cars in the U.S. are lubricated with Texaco than with any other brand.

* More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

*More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

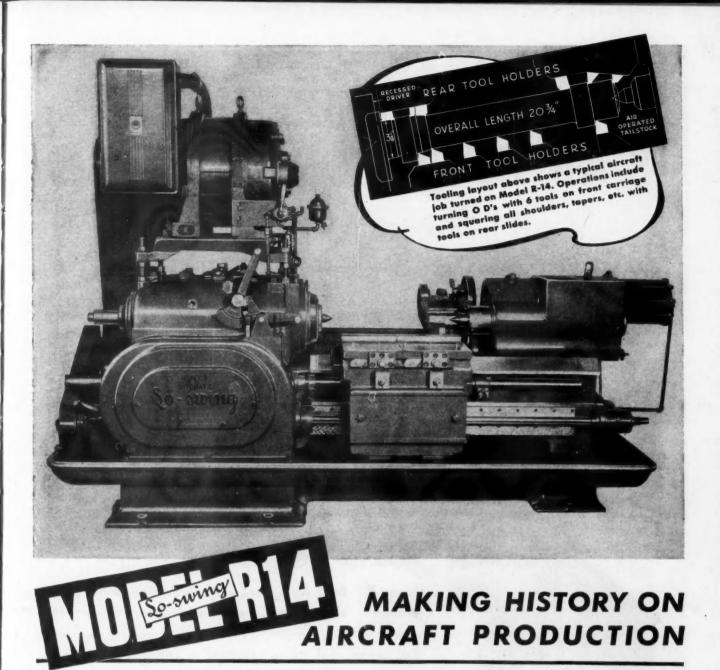
More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

*More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.



TEXACO CUTTING, SOLUBLE AND HYDRAULIC OILS MARKANING

TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT - CBS * HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY



● THIS BIG, powerful automatic lathe has set many records for low "per-piece" cost on aircraft motor cylinders, landing struts, tank, tractor and truck parts and other heavy war work. It incorporates the Seneca Falls Simplified Change-over Mechanism making it a practical machine for either short run or volume production. Length of carriage stroke and rapid traverse adjustment may be varied without changing any cams.

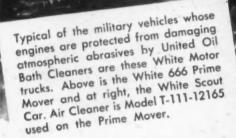
Positive operation, wide flexibility and servicing simplicity are important advantages of this design. Model R-14 may be equipped with a third arm (overhead) as well as additional back squaring attachments, carriages, carriage slides and work handling devices.

Write for condensed Catalog No. 42 showing the various types of Lo-swing production-boosting lathes.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

LATHE NEWS from SENECA FALLS

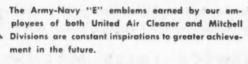
A CLEAN ENGINE IS AN EFFICIENT ENGINE





United Oil Bath Air Cleaners are providing better performance, longer engine wear, and lessened need of service attention on tens of thousands of military vehicles and commercial trucks handling a critically important job of war-time transportation on the home front.

The same high standards of quality and performance which are incorporated in United products serving these vast war equipment requirements will distinguish the improved products we shall have ready for the new engines that will power post-war trucks, tractors and automobiles now being planned.

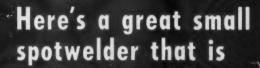




UNITED SPECIALTIES COMPANY

CHICAGO 28, ILLINOIS

MITCHELL DIVISION PHILADELPHIA 36, PA.



- *sturdy...
- * precise...
- * fast...
- * compact...

SCIAKY engineering has proved that it is possible to make a machine that is small, yet capable of delivering fast, high quality spot welds in day in and out production. Incorporated in this rocker arm type welder are exclusive features hitherto only used in larger machines. The use of heavy duty roller bearings at the fulcrum point of the arm, together with a special rubber cushion in the pressure cylinder, assure smooth action . . . eliminate hammering and wear. The design is compact with controls and contactor in a hinged cabinet . . dials are convenient to operator and unit may be easily installed or moved.

If your problem involves the fabrication of mild, stainless or zinc-coated steels and brass in light gauges, it will pay you to consider the "PMCR.0-1."

MODEL PMCR.0-1

Rated 30 KVA at 50% duty cycle for power supply of 440 or 220 volts, 60, 50 or 25 cycles. Capacity: clean mild steel from two thicknesses of .016" up to and including .080"— stainless steel up to a maximum of .040" plus .040". Speed on two thicknesses of .032" thick pickled mild steel is 180 welds per minute. Maximum electrode pressure at 24" throat depth is 1000 lbs.



Write for descriptive bulletin No. 112-A

SEIAKY

BROS

Manufacturers of a Complete Line of AC and DC Electric Resistance Welding Equipment 4915 W. 67TH ST., CHICAGO, 38, ILLINOIS

In England: Sciaky Electric Welding Machines, Ltd., London Branch offices in Detroit and Los Angeles



OF COURSE you'd want the one that will perform most efficiently, without noise or vibration—the one that will live the longer.

Sure, they look exactly alike. But there's far more than meets the eye in comparing them. It's the factor of static and dynamic balance. That's what determines their relative value to the user.

To eliminate guesswork and make sure that every armature will deliver the utmost in faithful service, alert manufacturers are correcting their unbalanced forces in the approved manner—with Gisholt Dynetric Balancing Machines*. If your product uses rotating parts, write Gisholt for complete information on your specific balancing problems.

*A development of Westinghouse Research Laboratories

GISHOLT MACHINE COMPANY

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With Gisholt Improvements

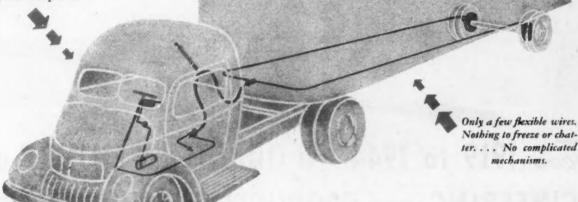


DYNETRIC BALANCING

assures smooth vibrationless performance in electric arc-welding generators. This large manufacturer balances the entire rotating assembly, including the fan as a complete unit.

WARNER ELECTRIC BRAKE for SIMPLICITY

A connection to the truck battery is all that is needed. Nothing special is required.



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The plug-in cable provides current for brakes, tail light, stop light and running lights.

Right now, the needs of our armed forces come first! However, if you are on the "essential" list we can supply you with brakes.



With Warner Electric Brakes, there is full clearance under tractor and trailer—nothing to get knocked off or leak—no exposed braking equipment—no rods to rattle—no tubing to split—no condensation to freeze. Warner Electric Brakes require only a wire to each wheel and will operate under water without short circuiting. Minimum maintenance cost.

WARNER ELECTRIC BRAKES

WARNER ELECTRIC BRAKE MANUFACTURING COMPANY . BELOIT, WISCONSIN



From 1919 to 1944 - a QUARTER CENTURY of ENGINEERING and PRODUCTION ACHIEVEMENT

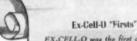
Solving difficult production problems for American industry has been the business of Ex-Cell-O since its inception twenty-five years ago. Often this has entailed the development of special purpose machines for single and multiple operations . . . to do work faster, more economically, and with a much higher degree of accuracy. Where the quantities have justified it, Ex-Cell-O has not only designed and built special machines to produce parts of improved quality but has undertaken actual production and assembly of these parts in its own plant, using to practical advantage Ex-Cell-O's complete heat treat equipment and widely-experienced production staff. 9

The days ahead . . . both war and postwar . . . are likely to offer a multitude of opportunities for the kind of engineering and production assistance that Ex-Cell-O can give so well. Consequently, the suggestion is made that, insofar as is practicable, your planning be started early. Ex-Cell-O's extensive facilities are at your disposal. Write to Ex-Cell-O in Detroit today.

EX-CELL-O CORPORATION

An Ex-Cell-O 25th Anniversary Book, illustrated above, has just been printed. If you would like a copy just write to Ex-Cell-O Corporation, 1200 Oakman Boulevard, Detroit 6, Michigan.

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EX-CELL-O was the first company in the United States to design and manufacture and introduce for suc-cessful commercial use...

- precision hall bearing into ing spindle

- power unit Diesel (see injection pump an aniversal-type Diesel engine nor machine to form and fill autom celly square paper milk bottler the dairy

EX-CELL-O was abothe first American company to undertake the mas production of hardened and groun-precision parts for aircraft engines

the black widow carries a deadly sting



DARK shadow streaks across the night sky. A newcomer enters the A battle on the side of Democracy. Bearing a lethal sting, the Black Widow, America's newest night fighter, packs the power to destroy anything that flies. Swift as an arrow, formidable as its famed namesake, this new ship, designed by Northrop, in co-operation with the Army Air Force's Matériel Command, promises a deadlier weapon to the men who are bringing victory to the United Nations.

And in the Pratt & Whitney engines that drive this most powerful of all pursuit planes are Foote Bros. Gears-gears that of necessity meet new standards in metallurgical and dimensional perfection.

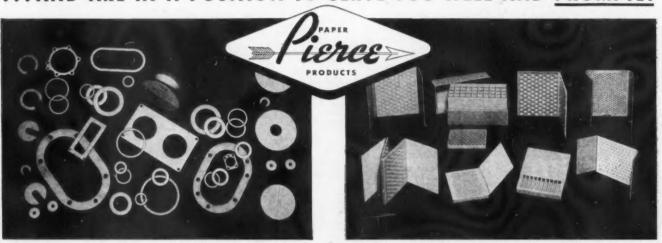
The Black Widow forecasts a new conception of design for the world of tomorrow—an era where high speed, the demand for greater efficiency, will find new uses for high precision gears. The engineering skill, production technique, manufacturing know-hows that have made possible the mass production of gears of such high precision may suggest applications in the development of machines you are designing for a world at peace.

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US HELP DEVELOP NEW USES TO MEET YOUR NEEDS. WE ARE EXPER-IENCED PAPER CONVERTERS... HAVE A NEW, UP-TO-DATE PLANT ... AND ARE IN A POSITION TO SERVE YOU WELL AND PROMPTLY



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Pierce industrial gaskets: manufactured to precision dimensions from paper, felt, cork, asbestos, synthetic rubber, leather or special compositions; meet specifications for resistence to oil, water, gasoline, heat, pressure. Die-cut specialties: produced by rotary press, platen press, punch press, or drawing methods from paper, felt, cork, special compositions.

PACKAGING AND SHOP PRODUCTION ENVELOPES

Pierce packaging envelopes for holding small flat parts; metal-top envelopes for secure fastening and convenient reopening; waterproof and greaseproof envelopes to meet all specifications; duplex shop-order envelopes — with protective glassine panels: the modern method of keeping blueprints and production orders together during work in progress.

NEW... SAF-T-PAK BOXES FOR SMALL PARTS

Pierce Saf-T-Pak Boxes: specially designed to individual requirements for the protection of small precision parts and other fragile items easily damaged in shipment. Can be produced from kraft, chipboard, or special compositions in a wide variety of forms with die-cut cells, cushion liners, partitions, other construction features of protective packaging.

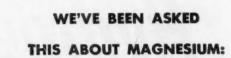
SPIRAL-WOUND PAPER TUBES AND CANS

Pierce spiral-wound tubes and cans: in diameters from 36" to 6"—any required length—from waterproof paper, kraft, chipboard, special compositions. Also, Pierce Saf-T-Pak tubes with felt liner for protection of fragile parts in shipment. Pierce protective caps and tubes for male and female threads: made in any size, waxed or plain.



* WRITE FOR SAMPLES AND COMPLETE INFORMATION

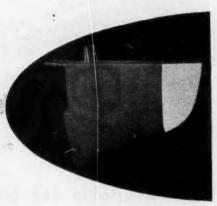
Manufactured by PIERCE PAPER PRODUCTS CO., 2720-A AUBURN STREET, ROCKFORD, ILLINOIS



Can magnesium be riveted?

Riveting is a highly satisfactory method of conjoining various Dowmetal Magnesium Alloy fabricated forms. In those fields of manufacture where the weight-saving and fine strength characteristics of a metal are important, Dowmetal offers a number of exceptional qualities to supplement the fact that it is the lightest of all structural metals.

Downetal is readily suited to hot or cold riveting by standard methods. Anodized rivets of the proper aluminum alloy are generally specified. Drilling is recommended in preference to punching, especially in heavy sheet or extruded sections. Flush heads are provided by machine countersinking or by dimpling with the correct tool. While either the squeeze riveter or hand gun can be employed, the former is preferred in most instances.



An example of the riveting of Downetal sheet, as applied to an aircraft vertical fin sub-

Dow, as the pioneer and largest producer of magnesium, has accumulated comprehensive technical data on the riveting of magnesium alloys, and on the application of the riveting technique to various types of Dowmetal fabrication. Too, complete facilities are maintained in the Dow plants for the actual production of riveted assemblies, in quantity as well as in small or experimental lots. Dow's experience and production capacities are readily available to assist you in any phase of Dowmetal riveting methods.

DOWNETAL magnesium



THE METAL OF MOTION

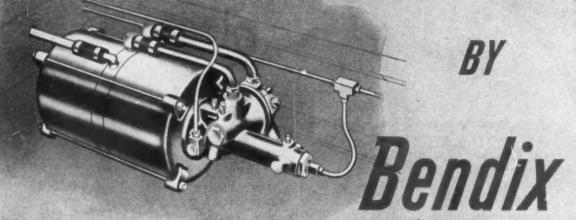
MAGNESIUM DIVISION • THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

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Postwar Braking now for today's essential hauling

Hydrovac

POWER BRAKING



Available for war essential trocks, tractors and buses



Here is a power braking unit with outstanding simplicity and dependability. Here is a power braking

Here is a power braking unit proved for safety and efficiency in millions of miles of military service. Here, in short, is the kind of unit you've looked forward to getting after the war. And qualified wartime users can bave it right now.

Hydrovac is compact, completely enclosed, with no external levers or link. It's simple to install—you can mount it anywhere on the chassis with only three tubing connections. And servicing is unbelievably simple—there is

nothing to adjust, either t installation or in service, and it is fully sealed against dirt and water.

Intrantaneous brake action is accur ely grad ated in response to the exact degree of pedal operation by the driver.

A normal "feel" or reaction on the brake pedal allows the driver to sense the exact degree of brake application or release.

Provisions for trailer connections allow fast, accurately graduated control of trailer brakes.

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BENDIX PRODUCTS DIVISION, BENDIX AVIATION CORPORATION

SOUTH BEND 20, INDIANA



AUTOMOTIVE and AVIATION INDUSTRIES

Volume 91

July 1, 1944

Number 1

Our Crude Oil Outlook

17

The petroleum reserves at this time are of paramount importance. In this article the author surveys the field, pointing out the probabilities and possibilities of the future.

U. S. Exports of Automotive Products

21

Yes indeed the good old industry is still scoring on the export front. Here is a page of figures that shows how much of what and when.

Six Colors Proposed For Safety Code

25

Safety is always an industrial problem of the first water. Much has been accomplished in this field incidental to our war program. In this article there is an attempt to coordinate and standardize some of the most successful experiments.

B-29, P-61 and Other Warplanes

34

On pages 34 and 35 there are a number of views of planes prominent for their records in the theaters of war. The text that accompanies these views is highly informative. It is a most complete article in capsule form.

Rubber Supplies After the War?

38

We are looking forward to an adequate supply of rubber for tires, as well as other industrial uses, in the postwar days to come. What can be expected and wishful thinking are two divergent tangents. Here is an account of what we will probably get.



Government Should Be Our Servant Not Our Master By James F. Lincoln

WE MUST, as Americans, determine the proper position of government in relation to our people. Is government the servant of the people, or are the people the servants of government? That will determine what kind of industrial system we are going to have, what standard of living we are going to have, who the employer is to be, and what kind of opportunity Americans are going to have. What is going to be the position of government relative to the individual? On that our whole future rests.

The record of American industry in this war is the greatest triumph ever achieved by any people. Remember, we have 130,000,000 people; we have limited natural resources; yet we furnish many of the tools of war to Russia with 200,000,000 and unlimited natural resources. We furnish most of the tools of war to China, with 400,000,000 people and unlimited natural resources. We furnish the tools of war largely to Great Britain with 650,000,000 and unlimited natural resources. All this in the face of governmental opposition and muddling almost beyond belief.

Why is it that America, with a population 10 per cent as large as that of the Allies, can do that? It is because of the American industrial system and the genius of the American industrialist. Remove him from this picture and the chance of victory for the Allies in this war would have largely disappeared.

In America each unit of industry germinates from a man with an idea. All industry is the result of exactly that—a man with an idea. He always starts from scratch and builds what he is able. That is the process which has made America great. Only here has there ever been possible the freedom of the individual which allows the occasional industrial genius to rise to any point that his ability makes possible. Only here is the individual free to develop his latent abilities to the limit.

Only under a free enterprise system can man develop in the way he has in America. Why is freedom so important? Man, as William James says, possesses powers of various sorts which he habitually fails to use. He doesn't develop automatically, but because of crisis and incentives. He must first have the opportunity, which is freedom, and secondly, the reason, which is incentive. In America he has had both.

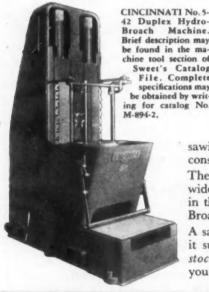
From an address before the Sales Executives Club of New York.

did
you
ever
try

CINCINNATI

BROACHING A NARROW SAW SLOT

at a rapid production basis?



CINCINNATI No. 5
42 Duplex HydroBroach Machine.
Brief description may be found in the machine tool section of Sweet's Catalog

File. Complete specifications may be obtained by writing for catalog No.

M-894-2,

Drawing of steel core, showing saw slot and two surfaces broached in right-hand station.

One of the most difficult operations on a surface broaching machine—that of broaching narrow saw slots—has been perfected by CINCINNATI Application Engineers to the point of a routine production job. An example of this type is illustrated here . . . a "broach-

sawing" operation combined with the broaching of other surfaces. Suppose we consider the broach-saw operation alone:

The part, shown in the sketch, is a small steel core. A slot about 7/16" deep x 1/16" wide in one end of the part, and two flats on the other end of the part, are broached in the right-hand station of the machine, a CINCINNATI No. 3-48 Duplex Hydro-Broach.

A saw slot of these dimensions is truly an innovation in the field of broaching. Does it suggest a more economical method in your own shop? Perhaps cutting off bar stock? Our engineers will be glad to discuss this possibility with you, and to show you how CINCINNATI Hydro-Broach Machines will fit into your production lines.

THE CINCINNATI MILLING MACHINE CO. SINGINNATI.

TOOL ROOM AND MANUFACTURING MILLING MACHINES... SURFACE BROACHING MACHINES... CUTTER SHARPENING MACHINES

AUTOMOTIVE and AVIATION INDUSTRIES Published on the 1st and 15th of the month July 1, 1944

Our Crude Oil Outlook

As during and after World War I, apprehension now exists in some quarters regarding America's future supply of crude oil. On the other hand, the Petroleum Industry War Council points out that "our oil future cannot be charted in advance; that our best procedure is to maintain a vigorous, dynamic oil industry competent to meet the problems as they arise and able to create new approaches through dynamic action."

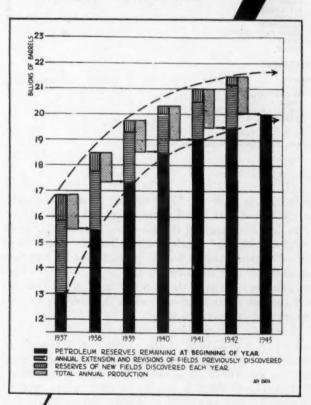
In this article, "Our Crude Oil Outlook," which is the first of a series of two articles on the mineral fuel resources of this

In this article, "Our Crude Oil Outlook," which is the first of a series of two articles on the mineral fuel resources of this country, the author summarizes our petroleum situation, supplemented by data on the rest of the world. The second article, which will be published in an early issue of Automotive and Aviation Industries, will present a comprehensive survey of the other mineral fuels—natural gas, shale oil and coal, the last named also with respect to its conversion into synthetic oil and gasoline.

O MUCH heat has been generated by the numerous current discussions concerning the crude oil outlook and therewith related problems that a restatement of the basic facts of supply and demand, objectively presented as a means of appraising the different arguments advanced, seems timely. This task is made easier by the fact that, no matter who happens to be Secretary of the Interior and whatever that official's political views may happen to be, the integrity of the Bureau of Mines statistics is conceded by all, even those who differ sharply regarding the interpretation to be given them. Proper evaluation of developments will also be helped if one divests one's mind of the impression that the adequacy of our oil reserves and that of adding to them by imports are brand new problems. When the number of registered motor vehicles crawled toward the ten-million mark 25 years ago, the press served up at regular intervals gloomier than gloomy forebodings of the future, and much that is found in the newspapers of those days regarding oil imports sounds little different from what we have been reading of

By W. C. Hirsch

History of Petroleum Reserves in the United States, 1937-1942.



Areas of World Classified as to Future Prospects for Oil

	GREAT	LARGE	IMPORTANT	SMAL
IORTH AMERICA				
U. S. A.		,		
Gulf Coast		1		
Midcontinent (incl. West Texas and N. M.)		2.5	1	
Rocky Mountains		•	1	
Gairrornia		•	2	
MEXICO CANADA			•	* *
CANADA			1.0	* *
CANADA CENTRAL AMERICA				
OUTH AMERICA				
VENEZUELA				
COLOMBIA				* *
	-			
ECUADOR				
ECUADOR PARAGUAY CHILE			• 7	100
ARCENTINA		**	2	
BOLIVIA		P.A		4.0
ARGENTINA BOLIVIA BRAZIL		1		
UROPE				
ENGLAND				
GERMANY				
FRANCE				
ITALY		1.5		ě
ALBANIA		19.44	4.9	
ALBANIA POLANID ROUMANIA SPAIN DENMARK HUNGARY CZECHOSLOVAKIA ESTHONIA		-	•	* *
SPAIN		•	44	24
DENMARK		1.4		- 2
HUNGARY				
CZECHOSLOVAKIA				
ESTHONIA			1 1	
RUSSIA:	_			
Baku Region			2.0	* *
	=			* *
Embo Region	-	•		
SIA				
RUSSIA:		1	1 1	
East Ural				
Sakhalin		•	200	3.4
North Arctic				
Turkaman riegion	•			
IRAK	2	•	1	
TADJIKSTAN and KHIRGEZ IRAK IRAN ARABIA KUWAIT	=	7.4		
ARABIA	-		1 1	
KUWAIT QATAR SYRIA BAHREIN		•	1	
QATAR		•	1 44	
BAUDEIN	1.4	4.40		4.1
BAHREIN TURKEY		1.4	•	
INDIA		100		
AFGHANISTAN				
BUNMA				**
PALESTINE	1.0	4		
PALESTINE		•		
JAPAN			3.4	2
USTRALIA	**	11		•
market and a second a second and a second and a second and a second and a second an				
AFRICA				
FOVET				-
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(Does not consider present discovered reserves)

late. In a book on "Petroleum," published, shortly after World War I had come to an end, we read that "the late Secretary of the Interior, Franklin K. Lane, very forcibly and patriotically called the attention of the American people to the possibilities of complete exhaustion of petroleum in the near future." This will suffice to modify the impression of many that the oil problem came upon us overnight, solely as an outgrowth of the present war.

Logically, the starting point for a study of the oil situation is a picture of the supply and inasmuch as we draw upon a number of foreign lands for a small part of our crude oil needs, this would be inadequate did it not present a picture of the entire world's supplies. This has to be supplemented by measuring the contributions of oil shale plants, natural gas and

gasoline wells as well as by the hydrogenation of coal and kindred chemical processes. Also into consideration must be taken that crude petroleum and cognate statistics revolve around estimates of reserves in known and proved fields, oil that may be extracted by present methods from fields completely developed or sufficiently explored to permit reasonably accurate calculations. Since the reflection seismograph has become the outstanding instrument for locating oil wells, the dependability of these estimates has come to be generally accepted.

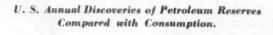
According to a statement presented to a U. S. Senate subcommittee by William B. Heroy, Director of Reserves, Petroleum Administration for War, last August, proved petroleum reserves of the United States were then estimated at 20 billion barrels. This figure was based on one of the annual appraisals of the American Petroleum Institute. Comparison with the estimates of reserves in preceding years is facilitated by the accompanying chart. Director Heroy, however, pointed out to the Senate Committee that there was a marked decrease in recent years in the volume of petroleum reserves per field discovered, as shown in the following table:

Year	Number of New Fields Reported	Petroleum Reserves Discovered, Proved and Possible (Thousands of Barrels)	Volume of Petroloum Reserves Per Field (Thousands of Barrels)
1936 1937	162 221	2,392,865 2,077,220	14,771 9,399 8,980
1938 1939 1940	256 254 304	2,298,806 816,596 1,463,759	3,215 4,815
1941 1942	341 348	976,444 507,229	2,863 1,458

Obviously the number of new fields discovered has increased while volume of prospective yield per field has progressively decreased. Moreover, only three fields found in the years 1939-1942 disclosed reserves of 100 million barrels. One school of thought ascribes this development to the more intensive work done on worthwhile prospects by

geologists while others are apt to be neglected, although some of the largest and richest oil fields found in the past were added to the Nation's sources of wealth by wildcatting and without benefit of modern geophysical test methods. It is pointed out that recent discoveries of promising oil reserves have been for the most part of what is known geologically as the structural type, which apparently lends itself profitably to present-day procedure.

Whether there is any justification for falling back on the economist's theory of diminishing returns to explain the apparent downtrend in proved oil reserves is difficult to say. After all, like in all industrial enterprise, cost is the determining factor of activity in one direction as against another, at least so in normal peacetimes. If the drilling of test wells en-



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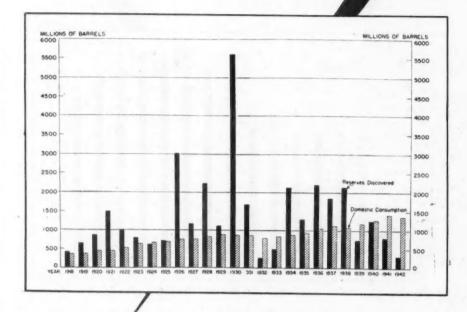
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tails costs out of alignment with those incurred in probing for more economically provable reserves, the lowest cost prospect is likely to become the common denominator until demand creates a market for the marginal product at a higher price. In the rough and tumble debates on oil reserves in the last few

months, many of the participants have conveniently sidetracked the intricacy of the problem to popularize it for discussion by the man in the street.

The following table permits comparison of United States crude petroleum production in recent years:

	Crude Oil Production (Thousands of Barrels)
1935	996,596
1936	1,099,687
1001	1,279,160
1938	1,214,355
1939	1,264,962
1940	1.351.847
1941	1,402,228
1942	1,386,645
1943	1,503,427

The 1 per cent decline in 1942 was caused, according to the Bureau of Mines, by a curtailment in refinery operations, resulting in turn from a decline in the demand and heavy reduction of stocks of refined oil. In spite of minor deviations from a one-way trend, it may be considered that the record of U. S. crude oil output in recent years reflects marked steadiness. By itself, therefore, and detached from whatever weight may

be given to estimates of potential reserves, the history of the immediate past furnishes a paradoxical background for predictions of an impending drying up of the supply. It is necessary to allude here to the preponderant importance of crude oil as a source of gasoline, lubricating oil and other petroleum products. Compared with crude petroleum production in the United States in 1939 of more than 11/4 billion barrels, that of related fuels: natural gasoline, benzol, power alcohol, and synthetic mineral oils from coal and shale was reported by the American Petroleum Institute to have been 54,148,000 barrels. World output of crude oil in 1940 was reported by the Bureau of Mines to have been slightly more than 2 billion barrels while that of related fuels was placed by the American Petroleum Institute as 108,000,000 barrels.

Output of refined petroleum products in 1942 was reported by the Bureau of Mines to have

been 1,334,000,000 barrels, 75 million barrels less than in the preceding year. This decline denoted the first repercussion of gasoline rationing which, it may be assumed, will make itself progressively even more felt in the years to follow. Having kept pace with the peacetime growth of its markets, the Ameri-

Estimated World Reserves in 1942

	WORLD RESERVES 1000's of BARRELS 1942	% WORLD RESERVES 1942	WORLD PRODUCTION 1938 1000'a BARRELS	PRODUCTION EXPRESSED AS % of 1942 RESERVES
J. S. A.	20.000.000	36,369	1,264,970	6,325
J. S. R. R.	8.500,000	15.457	210,000	2,471
ENEZUELA	5,600,000	10.183	190,000	3.392
OLOMBIA	500,000	0.909	22,000	4,420
MEXICO	675.000	1,228	38,000	5.630
ERU	160.000	0.291	17,200	10.750
RGENTINA	250,000	0.455	16,700	6,680
CUADOR	27,000	0.049	2,260	0.370
OLIVIA	40.000	0.073	150	0.375
RAZIL	1.000	0.002	100	0.0.0
RINIDAD	400,000	0.727	18,000	4,500
ANADA	135,000	0.245	8,000	5,926
LBANIA	21,000	0.038	750	3.571
ZECHOSLOVAKIA	8.000	0.015	150	1.875
RANCE	5.600	0.010	570	10.179
ERMANY	83,000	0.151	4.300	5, 181
USTRIA	50,000	0.091	400	0.800
UNGARY	75.000	0.136	1,000	1.333
TALY	1,000	0.002	100	10.000
OLAND	44.000	0.002	3.970	9.023
UMANIA	467,000	0.849	49,200	10.535
ETH. E. I. (Includes Bornen-New G.).	1,250,000	2.273	57.600	4,608
URMA	100,000	0.182	7.500	7.500
	50,000	0.091	2,500	5.000
PAN	25.000	0.045	2,680	10.720
GYPT	75.000	0.136	1,600	2,133
ERSIAN GULF AREA	16,450,000	29.913	115.380	0.701
THERS	10,400,000	29.913	9,800	0.701
TOTAL	54,992,600	100,000	2,440,880	3.718

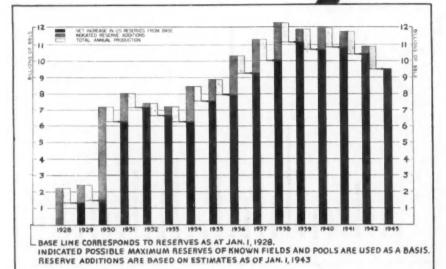
According to Petroleum Administration for War, estimated proven world's reserves, as of Jan. 1, 1944 were 51,183,800,000 barrels.

can oil-refining industry made an average of 18 gallons of automotive gasoline out of every 42-gallon barrel of crude before Pearl Harbor. According to a statement by Ralph K. Davies, Deputy Petroleum Administrator, to a House subcommittee, the war's demands necessitated cutting the production of gasoline to 12 gallons per 42-gallon barrel of crude last year, while the output of aviation gasoline, toluene, butadiene and other petroleum war products was stepped up from one-half a gallon to 31/2 gallons, seven times as much. What changes in refinery capacity these wartime alterations caused is not likely to become known until after the end of the war. This also precludes until then a clearer picture of the postwar factors of limitation of petroleum products output. Before the war, demand for certain major products, such as gasoline, appears to have had more influence on market conditions than any other factor. The ratio of available crude also undoubtedly affected, though perhaps to a

lesser degree, the market's undertone. Changes in the aggregate refinery capacity came in for relatively little attention, it being taken for granted that the industry would always provide ample facilities, anticipating any upturn in the demand. War curtailment of the supply of steel, which for a time pared the supply of drill steel for exploratory work, has hardly necessitated abandonment of or important changes in Government-approved plans for refinery extensions. The most difficult post-war job that will confront the oil refining industry will undoubtedly be adapting its manufactures to the requirements of a world at peace, not only in the barrelage output of each product, but also in their properties, slanted as these will necessarily be not to military but to the constructive requirements of peace.

Regarding the world outlook for crude oil supplies, James Terry Duce, director of the Foreign Division of the Petroleum Administration for War, testified before the O'Mahoney Committee that "in the United States we have drilled one well for every three square miles of land while in the foreign countries there has been but one drilled to every five hundred square miles." He added that "oil is easier to find abroad and is found in larger quantities; 300 fields which have been found abroad in the last twenty years have had an average estimated ultimate production of about 100 million barrels each, while the average field found at present in the United States does not exceed 2 million barrels in ultimate production." The accompanying tables give in detail Mr. Duce's figures,

Historical Chart Showing Increases in U. S. Reserves by New Discoveries and Decreases by Production, 1928-1942.



together with his estimate of world prospects, classified according to his appraisal of their respective importance. It may be noted here that crude oil imports have always been of marginal proportions, never rising above between 3 and 4 per cent of domestic production and offset by somewhat larger exports of crude.

Transportation has been a major problem of the petroleum industry almost from its birth in 1859. Three years later the first pipe line was built; by 1940 there were 126,400 miles of pipe line and in 1941, nearly a billion barrels of crude were transported in this manner. Bare cost of transportation via the "Big Inch" to the Government is estimated by Wallace R. Finney, chairman of the Special Engineering Committee of the Petroleum Administration for War, and J. B. Adoue to be 10.4 cents per barrel from Longview, Texas, to Linden, N. J., a distance of 1340 miles. At the present tariff rate, the Government receives 40 cents a barrel. Costs of transportation by pipeline, tank car, tank vessel and motor tank truck have been studied by a subcommittee on Post-War Readjustment of the Petroleum Industry War Council, but its findings have not yet been made public. The conclusions of this committee may help to shed light on the cost of transportation via the muchdiscussed Arabian pipe line as compared with tanker transportation cost.

It is this latter which has caused and continues to cause endless discussion. Defended as a war measure (Turn to page 90, please)

U.S. Exports of Automotive Products—1942

Item	Number	Value
Passenger Cars and Chassis—New		
Not over \$850	6.127	\$ 4.348,157
Over \$850 to \$1,200	6,947	6,930,128
Over \$1,200 to \$2,000	639	924,390
Over \$2,000	238	997,069
Total—Passenger Cars—New	13,951	\$13,199,744
Passenger Cars and Chassis—Used Truck, Busses and Chassis—New	1,770	1,153,117
Under 1 ton	23,185	\$20,759,636
1 ton and not over 1½ ton	72,725	79,646,532
Over 1½ ton and not over 2½ ton Over 2½ ton	46,667	90,584,772
Gasoline	10,991	47,148,383
Diesel and semi-Diesel	2,586	19,830,418
Bus Chassis	192	286,663
Total-Trucks, Buses and Chassis-		
New	156,346	\$258,256,404
Trucks, Buses and Chassis-Used	392	265,138
Trailers	2,013	3,517,740
Motorcycles	28,989	12,113,040
Motorcycle parts and accessories	*****	3,308,085
Automotive Engines for Assembly		
Truck and Bus-Diesel and semi-		
Diesel	345	\$492,619
Truck and Bus-Gasoline	24,093	3,829,206
Passenger Car	1,290	179,609
Diesel and semi-Diesel	111	120,176
Gasoline	1.967	359.147
Parts for Assembly		63,858,112
Automotive axle shafts	71.779	305,443
Pistons	11,119	956,029
Piston Rings		1,237,553
Valves	*****	332,456
VALVES *************************	*****	302,400

Item	Number	Value
Differential transmission gears		1,466,000
Gears, n.e.s.		761,234
Spark plugs	3.448.215	931,112
Auto and Truck springs		1:467.082
Parts for replacement, n.e.s		64,065,032
Horns, hand and electric	309.112	406,849
Other accessories		7.024.924
Starting, lighting & ignition equipment	/	1.455,965
Brake lining		.,,
Molded and semi-molded (lb.)	3,619,401	1,706,624
Not molded (lin. ft.)	749,449	283,900
Clutch facing	,	
Molded and semi-molded	995,996	354,795
Woven	436,446	203,720
Brake blocks	100,110	2001120
Molded and semi-molded (lb.)	746,255	197,679
Woven	54,455	37,272
Service Equipment and Parts	04,100	0.,
Tire Service Equipment and Parts		802,182
Pumps for gasoline and oil	10.492	350,280
Other service appliances and parts	10,102	2,283,511
Storage Batteries, 6 and 12 volt	304,430	1.811,979
Tires and Tubes	001,100	Tiorries
Truck and bus casings	932.177	29,132,167
Other automobile casings	253,354	5,096,774
Inner Tubes		3,385,301
Other casings and tubes		6.913,979
Solid Tires	414,012	0,310,310
Cars and Trucks	17.336	480.932
Other		23,607
Other	02,200	20,001

Source—Bureau of Census—Does not include exports to non-contiguous territories of the U. S. For 1941 data see page 139—March 15, 1944, issue of Automotive and Aviation Industries.

Monthly Production of Motor Truck Trailers*

1943	Civilian	Military	Total	1943	Civilian	Military	Total
January	556	11.785	12.341	September	477	19,811	20,288
February		8,767	9,692	October	420	21,456	21,876
March		10,915	11,845	November	518	22,264	22,782
April	567	11,471	12,038	December	793	23,276	24,069
May		10,487	11,098				
June	1.267	14,941	16,208	Total	8,054	188,811	196,865
July	698	16,866	17,564				
August	792	16.772	17.564	* War Production	Board.		

Monthly Truck and Truck Tractor Production*

		-Light1-			-Medium1-			-Heavy1		To	tal All Size	
1943	Civilian	Military	Total	Civilian	Military	Total	Civilian	Military	Total	Civilian	Military	Total
January		23,727	23,727		7,019	7,019	106	18,533	18,639	106	49,279	49,385
February	*****	23,314	23,314		6,453	6,453	226	17,327	17,553	226	47,094	47,320
March		27.544	27,544		8,268	8,268	284	19,781	20,065	284	55,593	55,877
April		23,107	23,107		9,717	9,717	247	23,026	23,273	247	55,850	56,097
May		21,217	21,217		12,696	12,696	304	20,940	21,244	304	54,853	55,157
June		20,734	20,734		14,070	14,070	395	21,263	21,658	395	56,067	56,462
July		20,925	20,925	*****	16,024	16,024	173	23,148	23,321	173	60,097	60,270
August		19,944	19,944		17,809	17,809	162	23,358	23,520	162	61,111	61,273
September		21,089	21,089		16,094	16,094	133	20,121	20,254	133	57,304	57,437
October		22,046	22,046	68	17,739	17,807	95	20,050	20,145	163	59,835	59,998
November		21,717	21,717	48	15.072	15,120	142	19,990	20,132	190	56,779	56,969
December		23,074	23,074	63	13,847	13,910	442	21,831	22,273	505	58,752	59,257
							-				400.044	
Total	****	268,438	268,438	179	154,808	154,987	2,709	249,368	252,077	2,888	672,614	675,502
1944												
January		21,479	21,479	1,985	13,369	15,354	546	21,667	22,213	2,531	56,515	59,046
February		21,095	21.095	1,798	10,440	12,238	968	21,911	22,879	2,766	53,446	56,212
March		21,081	21,081	3,318	8,854	12,172	1,308	22,376	23,684	4,626	52,311	56,937
April		19,533	19,533	6.229	7,038	13,267	1.887	21,465	23,352	8,116	48,036	56,152

*-War Production Board.
2-Light-Under 9,000 lbs. Gross Vehicle Weights, Medium 9,000-16,000 lb. G.V.W., Heavy 16,000 G.V.W. and over.

Speed Constructing Advance

Depends Upon

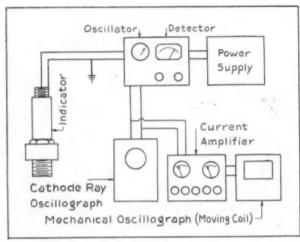


Fig. 1—General arrangement of condenser type indicator equipment.

The speed and efficiency of the Naval Construction Battalions (SeaBees) in constructing advance bases is in direct ratio to the amount and performance of their automotive equipment, Rear Admiral H. G. Taylor (CEC) of the U. S. Navy told the Society of Automotive Engineers at its National War Materiel Meeting in June at Detroit. The regular allowance list of a single Construction Battalion, comprising 1100 men and officers, calls for 12 jeeps, four 3/4-ton light pick-up trucks or weapon carriers, four 11/2-ton 6x6 light cargo trucks, four 21/2-ton 6x6 cargo trucks, and 32 of the 6x6 combination cargo and dump trucks, equipped with removable bow tops and seats

Improved Indicator for Measuring Static and Dynamic Pressures

By C. E. Grinstead, R. N. Frawley, F. W. Chapman, and H. F. Schultz, General Motors Research Laboratories

THE condenser-type engine indicator, with its associated electrical amplifying and recording equipment, is a compact and sturdy unit. It is easily serviced and, having a high natural frequency, is relatively insensitive to shock and vibration. Since no mechanical linkage is required between the pressure diaphragm and the electrically-sensitive element, there is an advantage over many other types of indicator. By the use of a low impedance link between the indicator and the electrical equipment, the oscillator detector unit can be operated as much as 100 feet from the engine. This affords the advantage of keeping sensitive electrical equipment away from hot air blasts and noise, and permits testing personnel to remain outside the engine test room.

Fig. 1 shows the general arrangement of complete equipment. The manner in which this indicator functions is briefly as follows: The diaphragm and the insulated electrode of the indicator form a condenser, the capacity of which is part of a tuned, resonant electrical circuit. Small changes in

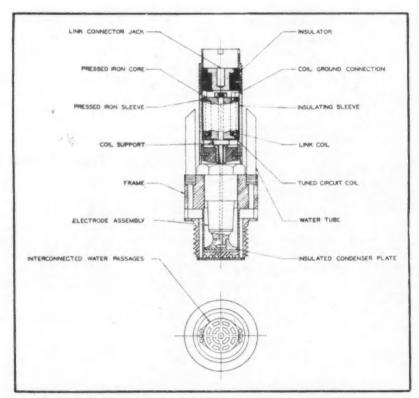


Fig. 2—Latest design of water-cooled condenser-plate indicator of high pressure type developed at General Motors Research Laboratories.

Military Bases Automotive Equipment

for personnel. Auxiliary automotive equipment, he said, includes a fourwheel drive ambulance, a maintenance trailer, four 1/4-ton trailers, two 1-ton trailers, two grease and lubrication trailers, one 25-ton low-bed machinery trailer, and four 300-gallon water trailers. In addition, supplementary equipment is usually provided for specialized jobs.

Admiral Taylor stated that since the start of the war orders totaling approximately \$225,000,000 have been placed for advance base work, approximately \$110,000,000 of it now being in service overseas.

Admiral Taylor tells SAE of its important role overseas; Variety of engineering subjects discussed at National War **Materiel Meeting**

> Eight technical sessions were held during the three days of the meeting, during which 16 papers were presented by prominent engineers. With the exception of one paper which is on the restricted list, the papers are presented herewith in abstract form:

the pressure on the diaphragm causes a change in capacity and are indicated by changes in the d-c electric output of the rectifier. Amplication and recording follow.

Some idea of the latest type of indicator may be had from Fig. 2. The assembly consists of four principal parts: a water-cooled frame and diaphragm; an insulated fixed-plate and electrode assembly; a coil assembly; and, an electrode shield and cable connector. The frame and diaphragm form an integral unit which is machined from a solid piece of Invar steel. This type metal is used to minimize the effect of temperature changes in the diaphragm. Water cooling keeps the temperature of the indicator within the range where the low thermal coefficient of Invar is realized, and also serves to cool the thin, copper plate which forms the bottom surface of the indicator. The electrode assembly consists of an Invar condenser plate mounted in a ceramic insulator. Complete electrical shielding is provided by a metal jacket which serves as both a unit shield and cable connector. This jacket also houses the coil assembly. The latter, in conjunction with the insulated condenser plate, forms the tuned circuit previously mentioned.

The principle of the condenser-indicator, and its associated electrical

equipment, is not limited to pressure The technique and measurements. equipment can also be applied to studying the amplitude and wave form of small deflections of moving bodies. Also, some uses in the automotive field are: Measurement of stress and strain; measurement of flywheel deflection; measurement of cylinder-head and gun pressures; and, jet propulsion block deflection; and, use in propeller- pressure studies. Engine detonation

shaft balancing machines. Other uses of this apparatus in various fields of engineering are: Measurement, or indication of unbalance in high-speed rotating machinery; measurement of vibration; pressure surges in oil circuit-breakers; measurement of waterhammer and other hydraulic surges;

Fig. 3 - Calibrated high pressure, combustion chamber record taken on an aircraft engine at 2600 rpm.

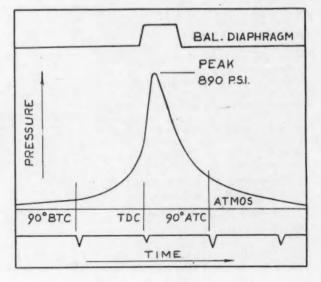


Table I-Machine Analysis for Processing Cylinder Heads.

							Per 3 Shift Day		
Machine	Area Sq. Ft.	No. of Machines	Mach, Load /1000 Eng.	Cost of Machine	Cost of Fixtures	Handling Oper.	Men Reg'd	Prod. Hrs	
Standard Machines	6,658	42		\$286,500	\$ 33,000	17	107	797.5	
				\$319,500					
Greenlee	2,890	1	0.323	\$244,266	\$ 69,000	2	8	7.8	
				\$313,266					
SAVINGS EFFECTE	D 3,768	41		5	6,234	15	99	789.7	

studies have also been made with this sion consisting of a hydraulic coupling instrument.

Some Aircraft Engine Production Methods

By Martin M. Holben, Wright Aeronautical Corp.

One of the principal problem to be solved by the Technical Production Unit was the need for highly-automatic machine tooling to offset the lack of a sufficient supply of skilled workers and to afford greater than ever quantity production. Parts which had required much handwork such as burring of sharp corners, blending of radii, hand-buffing and polishing were processed on automatic equipment. Finished parts showed less variation than was the case with hand labor and standard machine tools.

Cyclone cylinder work is typical of speed-up in production possible with automatic methods. Using a Greenlee Automatic Transfer Machine, 70 per cent of all the machining operations required are performed on a single machine in a one-way, 200-foot trip. These operations, previously executed by 46 skilled and semi-skilled workers on 46 standard machines on each shift, are now completely handled by 3 girls who can be trained in a few days. A master control panel takes care of all functions, and the type and location of any trouble is indicated by colored lamps. Cylinder heads are produced by this machine at the rate of one every 45 seconds. An analysis covering this machine is given in Table I. Other processes in the production of various engine parts have been similarly speeded and simplified for handling by unskilled, quickly-trained workers. Often, savings in production costs is a worthwhile by-product of automaticity of machines. Table II presents an analysis showing a comparison of automatic multi-operational equipment versus standard machine tools for processing the supercharger front sec-

Hydraulic Transmissions for Motor Vehicles

By Albert H. Deimel, Spicer Corp.

WHERE a hydraulic units acts simply as a clutch substitute it is known as a coupling, a typical example of which the Spicer Fluidgear Transmis-

sion consisting of a hydraulic coupling followed by a power-shifted transmission. When the vehicle reaches a certain speed, an electric governor sets up a circuit which, when the throttle is closed, is completed. This causes the gears to be automatically shifted to second gear. When the next predetermined speed is reached, a second circuit is set up and closing the throttle is a signal for the shift up or down until suitable vehicle speeds have been reached, and it will not shift until the operator calls for the change by clos-

blades, thus causing the turbine to rotate and drive the vehicle. After leaving the turbine, the fluid flows through the stationary blades which change the direction of flow. This causes a reaction which results in an increase in torque. For best results, the turbine is divided into three stages with three pairs of rotating, driven members and stationary, reaction blades. After the fluid leaves the final stage, it returns to the pump for recirculation. A gear pump is connected to the case to keep the fluid under pressure in order to prevent losses due to cavitation.

The converter as built has a maximum torque ratio of about 5 to 1, which occurs at stall; i.e., when the turbine rotating blades are held stationary by the vehicle load. As the load permits this output member to turn, the torque gradually decreases in step with the decrease in the speed ratio of the input and output members. At a speed ratio of 2 to 1 the losses in the form of heat reach a minimum.

With further decreases in speed ratio, the heat losses again begin to rise. When the speed of the output shaft approaches that of the input

Table II—Machine Analysis for Processing Supercharger Front Section.

		4					Per 3 Si	hift Day
Machine	Area Sq. Ft.	No. of Machines	Mach, Load /1000 Eng.	Cost of Machine	Cost of Fixtures	Handling Oper.	Men Req'd	Prod. Hrs.
Radial Drill Radial Tapper Vertical Mill and	760 231	5	4.1 0.875	\$32,500 3,600	\$ 5,000 2,000	4 3	13	98.5 21
Rotary Table	243	1	0.81	10,500	1,000	1	3	19.5
	1,234	7		\$46,600	\$ 8,000	8	19	139.0
				\$54	,600			
Greeniee	480 476	1	0.355 0.37	\$40,000 40,000		2	1	8.5 8.9
	956	2		\$80,000		3	2	17.4
ASVINGS EFFECTE	D 278	5		\$25	,400 more	5	17	121.6

ing the throttle, momentarily. Several buses equipped with this type of controlled, automatic hydraulic system have averaged 100,000 miles each in regular city service with good results.

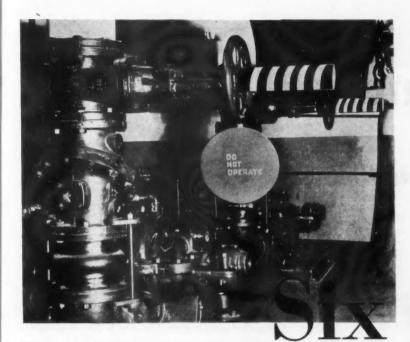
A refinement of the hydraulic coupling wherein a stationary set of blades is interposed between the driving and driven members of the unit acts as a torque converter and eliminates the need for mechanical transmission gearing. The Spicer hydraulic torque converter is typical of this development and includes the following essential parts: A centrifugal pump of high efficiency, driven by the engine; a three-stage turbine, acting as the driven member; and, a case surrounding the pump and turbine to contain the working fluid and carrying the stationary, reaction blades. The latter blades are curved so as to change the direction of the fluid flowing past them. The engine turns the pump and causes the fluid to flow through the turbine

shaft, the losses become too high for practical use of this type converter. Consequently, the Spicer converter is provided with an automatic, direct drive which takes over the transmission of power from the hydraulic unit when the output speed equals 2/3 to 34 that of the input. With this straight-through mechanical drive, and with the hydraulic drive at rest, maximum vehicle speed can be obtained.

Preservation of Vehicles and Component Parts for Storage and Shipment

By C. E. Heussner and C. O. Durbin, Engineering Div., Chrysler Corp.

THE conditions of storage and shipment during wartime are considerably more severe than during peacetime and require more care in packaging. Equipment packages must be prepared (Turn to page 76, please)



With or without the written warning "Do Not Operate" on the disk hung from this compressor control valve, employes will heed the color message "Do Not Touch" which is assigned to Precaution Blue. The horizontal shaft is properly made conspicuous by Visibility Yellow striping, a Color Code recommendation, calculated to prevent tall employees from bumping their heads.

Colors

Proposed for Safety Code in Industry

ALTHOUGH the use of color has been generally recognized as a medium for good housekeeping in industry and although color signals have been employed in various ways in the interest of safety, the establishment of ground rules cover-

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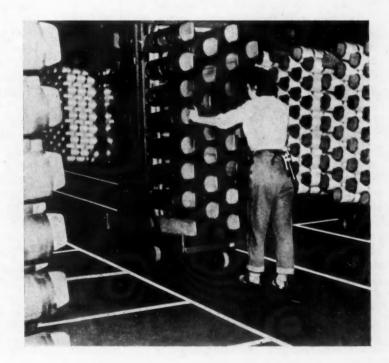
ing the use of color in industry evidently has not been formalized through recognized and universal standards. An important contribution along this line has been made by the Finishe's Department of du Pont in proposing two types of standards—a safety color code for industry; and "three-dimensional seeing," the use of color and light in the right combinations.

Based upon scientific research, du Pont proposes a uniform system of color signals in the form of a safety color code. Granting that color is frequently used for safety, many of its applications are said to be confusing and inconsistent. If red is used to indicate fire protection equipment, it should not be used, at the same time, to indicate plant hazards. One factory has its machine guards painted red which may imply that the safety device itself is a hazard. Such examples could be quoted indefinitely.

According to du Pont, if the use of color is to have meaning, it must be used with purpose and direction. It should do more than attract attention. Moreover, any identification based on color must respect previous usage. Thus, the identification of red with

fire, and of green with safety is traditional. Too, the factor of high visibility under all lighting conditions and the relatively high incidence of color blindness must be recognized.

Six colors have been selected for the safety color code (Turn to page 152, please)



Traffic White (or gray or black) marks traffic lanes, aisles and storage spaces. Where the aisle mark is adjacent to a hazard, yellow instead of white is correct.

Mass Production of Bendix-Weiss,

Constant Velocity Universal

This is the Ninety-fifth in the series of monthly production features

EXPLORATION of the literature indicates that conventional universal joints, regardless of design details, have been based upon variations of the first cross-type joint invented some 400 years ago by the scientist Jerome Cardan. Hence the origin of the term "Cardan joint" which is still in use today. Conventional universal joints have served the industry well over the years and unquestionably have a definite sphere of usefulness in motor vehicles, subject to certain known limitations in their application.

However, with the advance of motor vehicle design, engineers have developed applications of such character as to far exceed the adaptability of conventional universal joints. To cite but a few—consider the problem of transmitting power to the front wheels of a motor car, truck or other vehicle; or in the transmission of power where the angularity between the driven and driving members ranges from 20 deg to over 30 deg.

It is an accepted fact that the ordinary Cardan joint does not transmit uniform velocity from the driving to the driven shaft. It has been found that there is a cyclic variation in the form of an acceleration and deceleration of speed twice per revolution. The extent of such fluctuation depends upon the amount of angularity, roughly about 7 per cent for an angularity of 15 deg, and almost 30 per cent for 30 deg. To reduce the effect of these variations and consequent loss in power, as well as to prolong the useful life of a Cardan joint, designers have been forced to reduce shaft angularity to a minimum. It is possible to compensate for these fluctuations of angular velocity on propeller shafts, by positioning two joints in such

angular relation to one another that the variations of one compensates for the other; this requires, however, that the driving and driven shafts are to be maintained parallel to each other. Actually this condition cannot be guaranteed in practice due to torque reactions and spring deflections which produce variation in angularity. However, in torque tube drives where only one joint is employed, it appears impossible to eliminate fluctuations with conventional joints.

Inventive ingenuity developed the principle of the "constant velocity" universal joint which permits the transmission of uniform speed up to extreme angularity of driven and driving members. One of the earliest applications was made on the Cord front-drive car some years ago. Here it was necessary not only to compensate for extreme angularity but also to provide a smooth flow of power to the front wheels.

Three types of constant velocity joints are currently in production in the U. S. A.—the Bendix-Weiss type, manufactured by the Bendix Products Div., Bendix Aviation Corp.; the Rzeppa type, produced by the Gear Grinding Machine Co.; and the Tracta type, being produced by the New Process Gear Co. The latter is being supplied for jeeps and armored cars for military service.

At the present writing, the Bendix-Weiss joint has been produced in great volume for the front driving axles of military vehicles, including half-tracks, jeeps, and other types. The Navy also is using these joints in numerous applications on warships and other vessels. Bendix advises that its product was ready for general introduction to the automotive industry about the time that motor car production was halted by the war. Owing to the enormous quantities of joints required for the military program, Bendix has licensed a number of large vehicle producers and these have accounted for about half of approximately 2.5 million Bendix-Weiss joints that have been produced since 1940.

Similarly, the larger part of Rzeppa joint output has gone into the military program, principally for application on motor trucks, jeeps, tanks, tank service, wreckers, halftracks and others. The Rzeppa joint was adopted as a standard unit for Army truck front drive axles as early as 1930 and since then the output of the Gear Grinding Machine Co. has steadily grown to a yearly 400,000 units at this date. In addi-

Rzeppa, Tracta

Joints for Military Vehicles

tion, large quantities now are being produced by one of the largest automobile plants and its subsidiaries. Rzeppa joints also have found an important place in commercial, marine, and aircraft applications.

Generally speaking, the constant velocity joint offers great promise to automotive designers in transmitting power for front wheel drives, for rear engine drives, of all manner of drives where angularity exceeds conventional practice. Brightest possibilities for postwar applications are in rear engined motor cars, for the transmission of power where all wheels are independently sprung, for multiple-drive motor trucks, heavy off-the-road vehicles, for motor boat

drives, for machine tools, and for general machinery applications.

Constant velocity universal joints lift the usual restrictions that have confronted designers in the past. They permit a freedom from problems of extreme angularity as well as the life of the power train, thus enabling designers to develop mechanism purely from the standpoint of economy and functional expediency.

With this brief introduction to the subject, we shall treat each of the three principal makes of constant velocity joints, separately, from the standpoint of engineering design and some highspotting of unique manufacturing procedures.

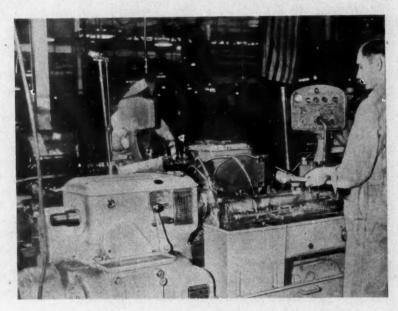
Bendix-Weiss—By continued development both in design and in production methods, the Bendix-Weiss joint has undergone considerable simplification. Currently, this joint consists of but two major parts—the two main yoke forgings. As illustrated, the assembly comprises the two yokes, four large balls, one large center ball, and two pins. In a former installation in the front wheel drive of an automobile, a joint was located at the wheel and another joint at the differential. The joint design at the wheel permitted a max-

imum angularity of 37 deg for steering and the other a maximum angularity of 16 deg. In addition, this joint allowed one inch of rolling end motion, thus eliminating the usual spline sliding. This feature is one of the basic properties of the Bendix-Weiss joint, namely, the ability to handle a certain amount of end motion without resorting to the use of a sliding spline. Front wheel drives of military trucks are equipped with a constant velocity joint at each steering knuckle.

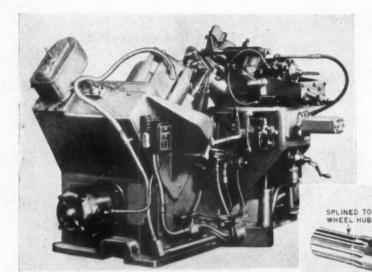
Assembly and dis-assembly operations are said to be extremely simple. The key to this lies in the role of the center ball which, in addition to taking end thrust

in the joint, also serves as the locking medium. For one thing, the assembly requires selective fitting of the four balls to provide the proper degrees of initial preloading. It is amazing to find how skillfully the operator selects balls of the right size with only a few tries. For assembly, it is possible to fit the center ball and three of the balls for the races with plenty of clearance. However, the fourth ball encounters interference with the center ball and that constitutes the secret of the locking medium.

To permit the fitting of the fourth ball, the center



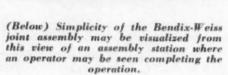
Close-up of one of a battery of Monarch Magnamatic lathes with Keller attachment used for turning Bendix-Weiss shafts.



(Left) Universal milling machine for producing the ball races in the yokes was developed by Bendix, built to order by Kearney & Trecker.

(Below) Parts that make up a Bendix-Weiss joint—two yoke forgings, five steel balls,

CENTER BALL SOCKETS





ing process is a basic consideration.

RETAINER

DRIVING YOKE

AXLE SHAFT

Although the production process has been so developed as to be a model of simplicity to the eye, over 123 operations are involved in the machining of the principal yoke members. Briefly the machining of a yoke involves the following major steps, simplified, of course, for our purpose:

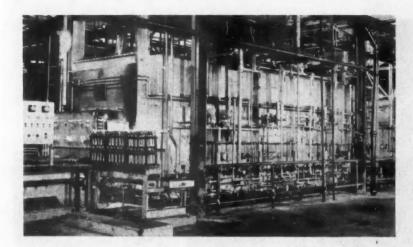
Cutting forging to length
Centering
Straightening
Turning the bearing sections at both ends
Machining the yoke end cavity and outside
Grinding the bearing section at the yoke
Forming the bearing races
Heat treatment including carburizing, hardening, drawing, etc.
"Hard" straightening before grinding
Grinding of bearings
Final assembly of the joint

ball has a milled slot of proper size which when held in the vertical position will enable the operator to insert the last ball. He tries the assembly for pre-loading, and if this condition is satisfied, he rotates the center ball so that the slot is in a horizontal position at the top. In this position a pin is inserted through the yoke into a drilled hole in the ball. Then the pin is locked in place by driving and staking another pin horizontally through a drilled passage in the yoke. To dis-assemble, the staked pin may be removed, thus permitting the ball locking pin to be removed. The center ball then can be rotated by hand so that the slot is again in the vertical position, thus allowing the balls to be easily removed.

Coming to the manufacturing process, we find that great stress is placed upon the selection of the right types of high-grade alloy steel for the yoke forgings, coupled with painstaking care in heat treatment so as to develop the correct hardness of ball races as well as the high physical properties of load-carrying members. Needless to say, quality at every stage of the machin-

The turning of bearing sections at both ends of the yoke forging is handled on a battery of Monarch magnamatic lathes with Keller attachments for automatically producing the required formation. Turning of the outside surfaces of the yoke end and formation of the yoke cavity is handled in a battery of Bullard Mult-Au-Matics, supplemented with a battery of Warner & Swasey turret lathes. A battery of the familiar heavy-duty Barber-Colman hobbing machines is used for producing external splines, either straight or tapered as the case may be. Finish-grinding of the bearing section of the shaft is done on large Landis grinders with angular heads for forming the radius shoulder at the yoke end.

Most dramatic operation is that of milling the bearing races. This really is the key to the economical and successful mass-production of the Bendix-Weiss joint. This is done on enormous special purpose milling machines, designed and developed by Bendix engineers, and built by Kearney & Trecker. The tool heads of these machines move in relation to the work so as to



Heat treatment of Bendix-Weiss yoke forgings is subject to close control in a self-contained department. Here is a view of one of the large Surface Combustion furnaces of latest type installed in this plant.

generate the correct curve for the ball races. Bendix employs two types of these machines—the one illustrated is a universal machine with adjustable tool heads which can be cycled to produce either straight or curved races; and another type which produces curved races only. In both instances, the machine has two tool heads, cutting two races at a time, so that the four races of the yoke may be completed in two operations. Assembly of the joint is done on benches, as illustrated, the finished joints being

hooked onto carriers on a monorail conveyor which transports them to the final inspection station. Here the joint is machine tested for preloading.

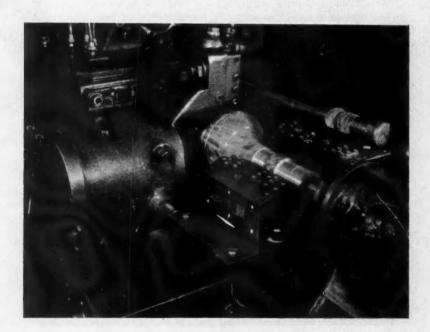
The Gear Grinding Rzeppa Joints—Machine Co. produces two distinct types of Rzeppa joints-the "disc" type, made in a range of five nominal sizes, and capable of a 15 deg. maximum deflection; the Bell type, made in a range of seven nominal sizes, capable of a maximum angularity of 37 deg. As illustrated, the Rzeppa joint is of the ball bearing type made with ball bearing precision. The bell type outer race is machined from an upset forging. It consists of a spherical joint housing, carrying the splined shaft end, a ball cage which carries the six balls and controls their movement in the joint, an inner race and a pilot. The accessory parts are six driving balls, pilot pin and, optionally, a spring plunger. The working surfaces are precision ground to standard dimensions to eliminate the necessity of selective assembly. The six driving balls carry the torque simultaneously in either

forward or reverse rotation, the balls being in close contact with the driving grooves at all joint angles. The assembly is capable of withstanding considerable end thrust, thus making unnecessary special mountings to prevent separation of parts. Wherever the shaft is required to slide in the splined inner race it is firmly supported by the close spherical fits of the three main members rather than by the driving balls, whose duty here is purely one of torque transmission. This feature is said to assure vibration-free rotation of the

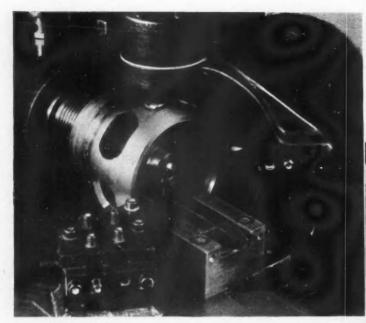
shaft regardless of the condition of worn balls and grooves. No tools are required for assembly or dismantling of the unit owing to design features which permit the elements to position each other securely by interlocking.

By skillful arrangement of the production process, by the use of some special machinery, and by improvisation of unique tooling on standard machines, the management has developed a very compact machine shop which is capable of turning out a large volume of the product. The entire operation is self-contained in one department, heat treating being done in a separate building.

An appraisal of this plant indicates that painstaking attention has been given to the details of each operation in the interest of meeting the requirements of fine tolerances and exacting quality of surface finish. All of the mating parts are finish-ground to the quality

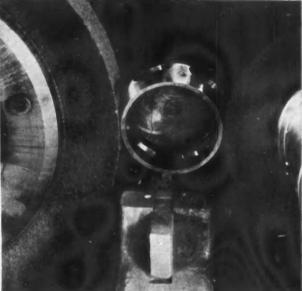


One of a battery of Gisholt automatic lathes with massive tooling for turning the Rzeppa outer race bell forging. The box tooling in the foreground handles the stem end; the special arm at the left forms the OD.



(Left) Close-up of work station of one of a battery of Lodge & Shipley lathes used for turning Rieppa joint cages.

(Below) OD of the Rzeppa joint ball cage is ground in Cincinnati Centerless grinders, this being a view of the work station.



and the close precision of a fine ball bearing.

Considering a few of the major operations, it is not surprising to find a generous use of GearGrind equipment which this organization produces for industry. Apart from the familiar GearGrind precision grinding machines used for finishing races and splines, there are two special race grooving machines developed by GearGrind for the production of Rzeppa joints. These are found on the outer race bell line for the initial straight grooving, followed by another operation for spherical grooving.

Due to the sphericity of the major elements of the mechanism, unique attachments have been developed

for standard machine application. One striking example of this is the use of automatically operated pivoted arm tool holders on the Gisholt lathes. One setup incorporates this attachment for turning the spherical

Factory Routings for Major Rzeppa Joint Elements

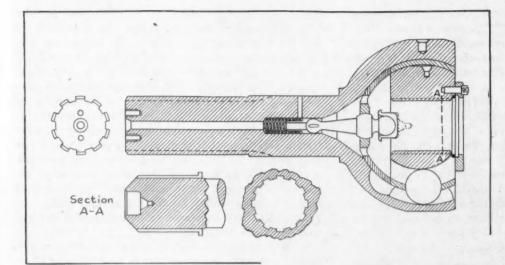
OUTER RACE BELL EQUIPMENT Center both ends Garvin Centering machine Turn OD complete Gisholt #12 automatic Gisholt #12 Advance engine lathe Gisholt #12 automatic Fosdick drill press Finish turn bearings and flat Drill and tap Copper plate Finish turn ID Gisholt #5 turret lathe Barber-Colman hob-bing machine Gear Grinding special drilling machine Hoeffered drill press Geometric threader Hob splines Drill straight and spherical grooves Bell cotter keyholes Thread Geometric threader Inspect Heat treat Finish grind hearings and Norton grinder shoulder Grind spherical ID Heald internal Heald internal grinder Gear Grinding grinder Gear Grinding spline Grind grooves Grind splines grinder Break corners Assemble CAGE Turn ID complete and face LeBione. Lodge & Shiple, gine lathe Sharpe LeBlond engine lathe

double end mill

Turn OD complete and face

Mill flats

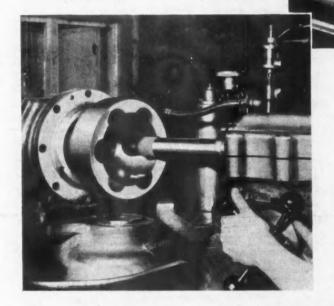
	OUTER RACE	BELL	EQUIPMENT
	Broach slots		American broach
	Burr		Bench
	Inspect		
	Heat treat		
	Grind faces		Blanchard grinder
E	Grind slots		Gear Grinding ma- chine
	Grind OD complete		Cincinnati centerless grinder
	Grind ID complete	E	Heald grinder
8	Drill and counterbore		Baker drill press
Will Co	Broach		American broach
3	Turn OD and face		Bridgeport engine lathe
	Center 6 hobs		Buffalo drill press
	Turn 6 grooves and ch	namfer	Sundstrand stub
	Drill 3 holes and tap		Royal drill press
	Burnish		Greenerd hydraulic press
	Inspect		
	Heat treat		
	Grind face		Landis cylindrical grinder
	Grind OD spherical		Norton cylindrical grinder
	Grind grooves		Norton cylindrical grinder
	Re-tap		Bench-Hand tap



(Left) This drawing illustrates a typical Rzeppa Bell joint assembly.

(Below) Close-up of work station of Norton grinder in Geargrind plant, showing ingenious fixture for holding Rzeppa joint inner race for groove grinding. It may be noted that work is indexed three times for completing the six grooves, using a special formed wheel.

(Below) Specially-designed Gear Grind grinder developed for the contourgrinding of Rzeppa joint ball grooves in the outer bell.



The inner race is an extremely intricate part to machine due to formation of the outer spherical surface and of the six ball races. The center hole is spline-broached on an American Broach. The most exacting operations are found in the finish-grinding, after heat treatment, of the OD and the races. These are handled on Norton grinders, using formed wheels. Formation of the OD is rather simple with the use of a formed wheel and development of the proper workholding fixture. However, the form-grinding and indexing of the ball races posed some difficult problems. These were solved by the development of a unique work-holding fixture on the Norton grinder in which the work is held and indexed while rotated on an arbor at right angles to the principal axis of the work. This arrangement permits the form-grinding of two grooves or races at a time.

Another of the major machining problems that may be readily visualized is that of interrupted cuts. This is a feature of many of the parts and requires constant attention to work-holding fixtures, machine condition, and quality of cutting tools.

Noteworthy feature of the layout of this department is the use of the familiar Bull-Dog power duct system, ceiling-mounted over the machine lines for distributing power to the machinery. It promotes good housekeeping, simplifies the problem of moving machines at will or introducing new machines where necessary.

OD formation; another has a similar device for finishing the cavity.

Stemming from this company's specialized experience with form-grinding, this technique is applied on many of the grinding operations. One example is grinding on the Cincinnati Centerless, using a formed wheel for the contour.

An interesting feature of the machining of the cage is the broaching of slots for the six balls. This is done on a special American Broach, broaching the slots in pairs. The OD is finish-ground on a Cincinnati Centerless, the ID on a Heald internal grinder.

Tracta Joint - New Process Gear Manufactured by the Corp., this joint is of French origin and in prototype, at least, is said to be produced extensively in Europe today. Reference to the illustrations, shown elsewhere in this article, will indicate the uniqueness of design and relative simplicity of production methods. Currently, the Tracta joint is being supplied for installation on jeeps and armored cars. For postwar, it will be groomed for use in motor vehicles and for many industrial applications.

It consists, essentially, of four parts-the right hand and left hand forked shafts, the female (or slotted) joint, and the male (or spigot) joint. The mating surfaces of the four elements are lubrized to promote initial run-in, after installation, to prevent scuffing and to develop long-wearing assemblies. In addition to the simplicity of machining, no initial assembly is required for shipment. For axle installation, the Tracta joint is recommended for a working angle of 38 deg., although for other applications the angularity may be increased to as much as 45 deg.

When New Process Gear decided to undertake the manufacture of the Tracta joint, the design was subjected to thorough analysis based upon the wide experience of the company in automotive product development. The four principal elements were redesigned to produce a better proportioning of stress-carrying sections so as to increase load-carrying ability. In addition, materials were selected in keeping with automotive practice rather than with the practice of European producers. Thus the two joint sections are made of a carburizing grade of high alloy steel while the shafts are made of heat-treated axle steel possessing high physical properties. The net result of the combination has been an overall reduction in joint size and weight for any given application.

In keeping with production volume and simplicity of design, the parts are machined in a series of conventional operations, employing available standard machine tools. However, methods of striking modernity have been introduced. One of these is the adoption of

Factory Routings of Major Tracta Joint Parts

SPINDLE SHAFT — FRONT

Anneal and shotblast Grind chamfer on 1 fork prong, Grinding stand both sides and remove rough spots on stem. Visual inspect rough Mill to length (spline end) shafts at a time) (2 Universal miller Gage to bench fixture

enter both ends and gage Roll on bench centers and Punch press straighten when required & finish turn complete. Automatic lathes Inspect Soft grind 1.245 in. dia. & radius. Cylindrical grinder

Broach both inside and outside Duplex vertical broach dimensions. Inspect Chamfer 0.060 in. x x 0.080 in. x 1-spindle drill

45 deg. both sides & wash. Inspect Hob 10 splines. Inspect Lead drill spline end. Inspect

OPERATION

Drill & co-sink 29/64 in. holes at right angles
gage 5%
Cut % in.—16 threads and gage 2-spindle bon
Burr complete, and break sharp
Bench and file
corners. (Both fork and spline right angles to each other &

Inspect 100% Heat treat—Rockwell inspect Wire Brush

Straighten & indicate. Visual in-Sandblast fork end. Visual in- Sandblast cabinet

Wash, lubrize and rinse. Visual Lubrizing equipment inspect Hard grind 1.237 in dia. Inspect Cylindrical grinder (must be smooth)

Hard grind 10-spline dia, and in- Cylindrical grinder spect Tape bearing and fork end. Visual Bench inspect

Shotblast. Visual inspect Remove tape and wash. Visual inspect Final inspect 100%

EQUIPMENT

Centering machine

Hobbing machine 1-spindle drill 2-spindle drill

2-spindle bolt cutter

1-spindle drill press

Shotblast cabinet

TRACTA JOINT - (MALE)

EQUIPMEN
nch grinder

Break sharp corners and burr 6 Bench edges of spigot slot before cen-Visual inspect tering. turning fork Centering machine Drill centers for

slot, gage Rough & f & finish turn fork slot Automatic lathes complete. Inspect

1st & 2nd rough & semi-finish and finish spigot slot. 2 at a time & inspect Mill flat on fork slot

Hand mill 19/16 in. radius both Hand miller sides of spigot Slot, wash, inspect Pedestal grind Blend in forging with side of Bench grinder Pedestal grinder spigot slot

Visual inspection break corners of Double end grinding Vash stock, break corn machined edges & burr stand Visual inspect

File complete to remove all burrs, stamp, wash and move stock to inspection bench

Soft inspect 100% Heat-treat-Rockwell Inspection Sandblast with fine sand all over

Grind both sides of spigot com- Rotary grinder Polish radius on outside dia. of Polishing stand spigot

Sandblast after polishing edges Sandblast cabinet of spigot Wash, lubrize, rinse and dip in

hot soluble oil Hard inspect 100%

Segregate for size of spigot in Bench gage, stone off burrs and mark classification

Sandblast cabinet



(Left) Principal mating parts of the Tracta joint. The forked axle shafts are at the extreme left and right; the female joint is at the left, male joint at the right.

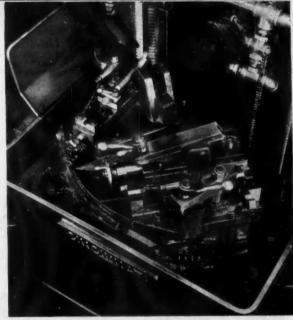
(Right) View of new heat treating de-partment for the shaft ends of the Tracta joint, featuring Lindberg pittype furnaces with automatic temperature and time cycle control. The method of loading shafts in vertical position may be seen in the center at the quenching station.



(Lower Right) Close-up of work station of one of the Cincinnati Duplex surface broaching machines at New Process Gear, showing the detail of workholding fixtures and broaches. At the left is the station for broaching the sides of the Tracta fork. At the extreme right is the broaching station for the fork opening. In the center is the broaching of the slot in one of the other forgings.

two huge hydro-broach duplex vertical type surface broaching machines for broaching the sides and bore of the ends of the shafts, also broaching the spigot slot in male joint. A specialized heat treating department is provided for hardening and drawing the axle shafts in a battery of pit-type furnaces.

Referring to these routings it is of interest that the male and female joints are finished for selective assembly by mating at the final grinding operation and are wired together for shipment. To this end, the male spigot is ground selectively to fit the milled slot in the female joint, thus making unnecessary the use of fussy tolerance in machining the slot. All of the four parts are inspected for surface perfection in a Magnaflux machine.

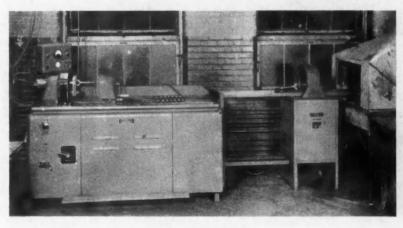


It may be noted, too, that the fork ends subtend an angle greater than 180 deg. of arc so as to be selflocking once assembled in place. For this purpose, a

> flat is milled on the cylindrical section of the joint so as to permit the fork to be inserted in place.

> Finally, it is stated by the manufacturer that the property of constant velocity claimed for the Tracta joint may be readily demonstrated both mathematically and by physical checking. Moreover, it is claimed that the joint has high load carrying capacity

(Turn to page 90, please)



All parts of the Tracta joint assembly Magnaflux inspected in the special machine shown here.

B-29, P-61 and

FOLLOWING the raid June 15 over Japan with Boeing B-29 Superfortresses, first details of this now long-range warplane revealed it as America's largest bomber, its size and performance making necessary a reclassification of

bombers. The B-17 and B-24 now become medium instead of long-range bombers, and the B-25 and B-26 become short range bombers. The B-29 has a wing span of over 141 ft, is nearly 100 ft long and has an overall height of over 27 ft. It is equipped with a tricycle gear, with double wheels on the main landing gear and at the nose. B-29s are in production at the Boeing factories in Seattle and Renton, Wash., and Wichita, Kan.; at the Glenn L. Martin plant in Omaha. Neb.:



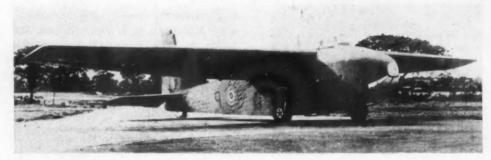
Official U. S. Army

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and at the new Bell plant in Marietta, Ga. Fisher Body Div. of General Motors has a major role in the fabrication of subassemblies. The 18-cyl, radial air-cooled Wright engines of 2200-hp each are being built by Wright and at the Dodge-operated plant in Chicago. Dual set of turbo-superchargers are installed with each engine, which is equipped with a 16½ ft four-bladed Hamilton Standard propeller. Armament consists of .50-cal machine guns and a 20-mm cannon.

(Below) The Hamilcar glider, carrying a tank, was one of Britain's surprise weapons during the Normandy landing in France.





(Above) The latest Douglas A-20 Havoc fighter bomber with a power turret housing two .50-cal guns added to it, increasing its armament to nine .50-cal guns.

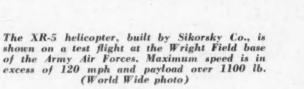
Other Warplanes

The P-61 Black Widow, designed and built by Northrop, is a night fighter equipped with special instruments for that purpose. The white mark is a deletion made by the censor. It is powered by two Pratt & Whitney engines. (Acme photo)





The P-61 from the rear. (International News Photo)

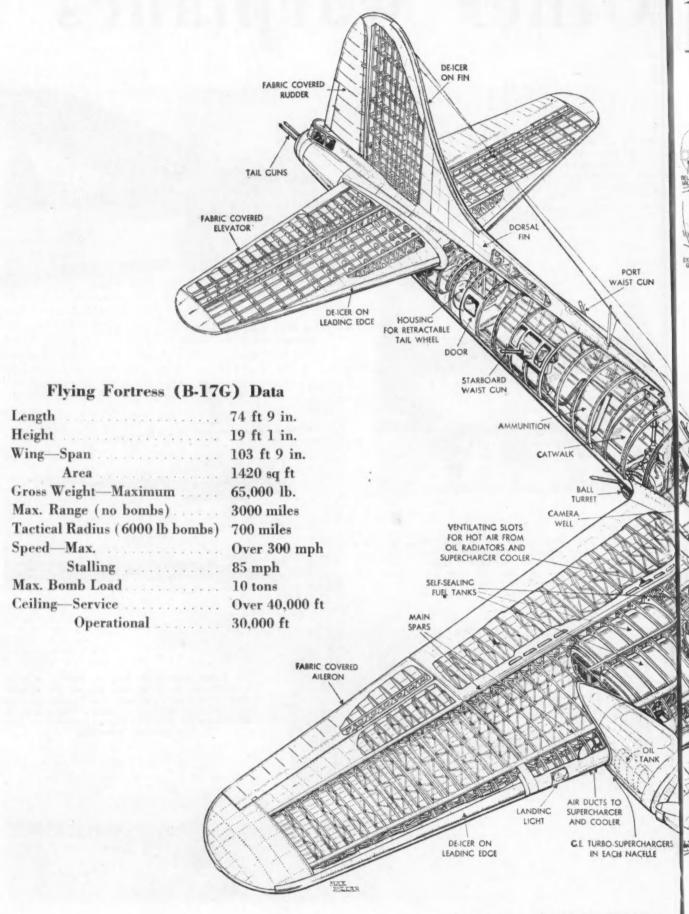




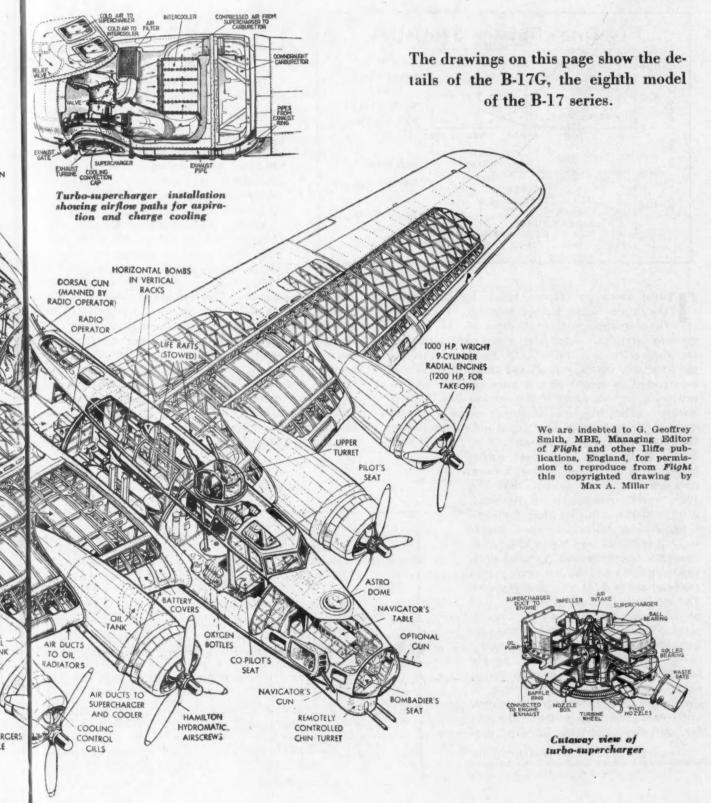


The Fairey Barracuda torpedo bomber now in service with the Fleet Air Arm of the British Navy. New features include the Youngman flap and a high-set strutted tailplane. The engine is the Merlin 32 model. (Photos courtesy of The Aeroplane, London.)



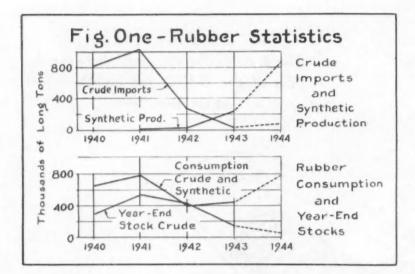


Boeing Flying Fortress



ES

Will Adequate Rubber



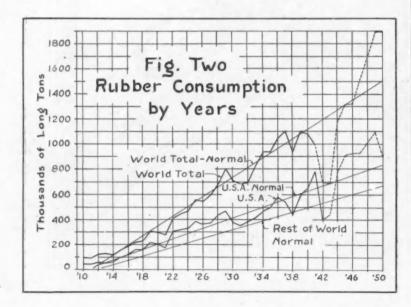
There are many reasons, today, for questioning the future of the Rubber Industry. Because of the Japanese seizure of most of the rubber-growing territory, the industry is just coming through the worst crisis of its history. To counteract the rubber shortage, the rubber, oil and chemical industries constructed, in record time, a huge synthetic rubber producing project, which is now coming into full production. What happened to rubber supplies in this country during the past four years and the projection for this current year is shown in Fig. 1. The year

1941 was the year of highest rubber consumption in United States' history, although on two occasions, 1937 and 1939, world consumption hit its maximum, which was higher than for 1941. Crude Rubber Imports dropped sharply in 1942 and were very low in 1943. Consumption of rubber was curtailed drastically in 1942 and 43, but even so, the year-end stocks went steadily downward. The synthetic production story is seen at a glance; 1944 is the real turning point. These figures show how close we have been to disaster, how the high imports of crude in 1941 gave us the breathing space which enabled us to build the synthetic program just in the nick of time to pick up the burden of the exhausted crude rubber. The rubber production is rolling in. The proVice President in Charge of Research and Development, The Goodyear Tire & Rubber Co.

duction of rubber goods is rolling out. At some time between Mid-summer and Fall the rates of both will be in reasonable balance and our crisis will be nearly over.

When the Japanese over-ran the greater part of the rubber-producing area, the plantation acreage was something over eight million acres and had a production capacity of about 1,600,000

long tons per annum. This acreage was nearly evenly divided between native and European ownership. The expected capacity of the synthetic rubber plants, of all types, is about 1,075,000 long tons per annum. Thus there is a potential postwar capacity of crude and synthetic rubber of 2,675,000 long tons, besides which must be mentioned, but not necessarily considered as an economic factor, some 200,000 tons of synthetic production capacity in Germany, Russia, Italy and elsewhere. The highest world consumption of rubber was 1,104,000 tons in 1937. This country's



This article is from a paper presented by Dr. Dinsmore at a recent meeting of the National Association of Purchasing Agents in New York City.

By Dr. R. P. Dinsmore

Supplies be Available

after the War

highest consumption was 783,000 tons in 1941.

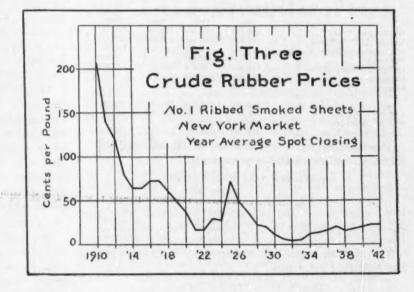
In appraising the future, only potentials can be developed with any accuracy. To what extent potentials are realized, if at all, depends upon many factors, some of which are now unknown, so I shall

simply show what potential possibilities the present facts indicate. Although I have been familiar with rubber consumption statistics for years, it was only recently I observed that the rubber consumption figures for the United States, in the past 30 years or so, tend to fluctuate around a normal line, shown in Fig. 2, much as economic activity does. This line to be sure is not one of constant volume, but rather one of constant increase. The figures for world consumption are somewhat less certain in this respect and it is possible that they follow a curve or that the normal line is broken.

It is also important to observe that the major use for rubber, in this country and in the world, is for tires and tubes, in which the automobile tire preponderates. Therefore, to some extent, rubber consumption figures for the past 20 or 30 years merely reflect the growth of the automobile business. Certainly any major change in the pattern of that

industry would alter the rubber consumption curve. Perhaps such a change is in the making. I shall make no effort to decide that question. As to world consumption of rubber, it is obvious that in a world of two billion people, it cannot be expected that a country of 133 million will continue to consume a major proportion of such a useful commodity. From 1910 to the late twenties, this country used very nearly 75 per cent of the world's consumption. From then until 1940 the trend was much more nearly toward 50 per cent. Any impetus toward industrialization abroad will tend to increase the slope of the consumption curve for the rest of the world. Any change in our automobile absorption pattern will tend to vary the slope of our consumption curve. There is little doubt that the former was under way before the war and will probably develop faster after the war.

If you examine the curves for rubber absorption



you will note these trends. A few years more, without war, would have established a trend for world consumption, as being either along the normal line indicated or following a new upward sweep. The normal line for the U. S. A. indicates a tendency to increase consumption, every ten years, by an annual rate of about 210,000 tons. The rest of the world increases at the rate of about 175,000 annual tons per decade, giving a total world change, per decade, of 385,000 annual tons.

The advent of the war threw consumption figures far more out of line than the previous war, for obvious reasons. The actual world figures from 1941 on are not definitely known. They have been estimated on the liberal side. If the effect of striving toward a normal line, by making up the deficiency of goods caused by war conditions, is resumed post-war, there will be a violent fluctuation above the normal line. In

this connection it should be remembered that rubber consumption during the war has, so far, been heavily on the side of military equipment and very limited in the direction of supplying civilian needs.

The projected curves for 1944-1950 show a possible rubber consumption, which brings the United States back to normal balance by the early part of 1947, and, thereafter, by 1950 runs 920,000 tons over normal. The rest-of-the-world figure does not counterbalance sub-normal consumption even by 1950, leaving it 770,000 tons sub-normal. However, if military uses are deducted, by 1950 the U.S. A. is still 630,000 tons sub-normal and the rest of the world is 3,270,000 tons sub-normal. I believe this to be the more valid use of the normal line. It also appears possible that the U. S. A. will be required to function for part of the outside world, for a time, after the war. In order to give more reality to the estimates of U.S. A. consumption, the following table indicates potential requirements for various classes of rubber goods, based on known shortages and for 1945-1948 only. The annual figures are based on the assumption that the war will terminate in 1946. A different termination date will affect the figures accordingly.

RUBBER REQUIREMENTS

	1945	1946	1947	1948
Passenger Tires	221,400	330,800	440,000	424,000
Truck & Bus Tires	233,300	260,000	286,500	296,000
Mechanical Goods	35,000	60,000	80,000	100,000
Footwear	15,000	30,000	40,000	40,000
Other Civilian Uses	10,000	30,000	80,000	150,000
Military	400,000	210,000		
Export	150,000	150,000	*****	*****
1	,064,700	1,070,800	926,500	1,010,000
U.S.A. Civilian	514,700	710,800	926,500	1,010,000
U.S.A. Military	400,000	210,000		*****
U.S.A. Total	914,700	920,800	926,500	1,010,000

The passenger-tire requirement is based upon the following estimated tire requirements:

PASSENGER TIRE PRODUCTION

Original Equipment	Renewals
1945. 10,000,000 1946. 20,000,000 1947. 30,000,000	30,000,000 40,000,000 50,000,000
1948 37,500,000	40,000,000

The civilian truck-tire requirement is based upon the following estimates:

TRUCK TIRE PRODUCTION

	Original Equipment	Renewals
1945	600,000	8,000,000
1946		10,000,000
1947		10,000,000
1948		8,000,000

The cushioning and energy-absorption capacities of rubber have developed certain outstanding applications that have proved their merit and are certain to advance in the postwar era. The potential ranges suggested are annual figures including original equipment and replacements.

LATEX FOAM SPONGE

L	ong Ton	s Rubber
Automobile Cushions	10,000	- 25,000
Truck Cushions	4,000	- 10,000
Bus Cushions	250	40.00
Coach and Pullman Cushions	1,000	- 2,000
Furniture and Mattresses	1,500	- 2,500
TOTAL	16 750	40.000

Rubber-Spring suspensions for automobiles are on the way to replace steel springs. This use may require from 10,000 to 25,000 long tons of rubber. Vibration Dampeners for industrial machinery and for railroad trains had begun to demonstrate their value prior to the war. The amount of rubber required per item of equipment is small, but the number of machines is tremendous. A tentative estimate is placed at from 1500-6000 long tons. Rubber tires are developing the use of farm vehicles, tractors and other implements. It is quite probable that rubber cushions and shock-absorbers will be employed to reduce the fatigue of the operator. Such vehicles and implements should require from 10,000-20,000 long tons of rubber, for all purposes.

One further use of rubber deserves brief mention. It is the use as a starting material for chemical reactions. Rubber derivatives suitable for lacquers, adhesives and plastics can be made from natural rubber and suitable synthetics, which will be in increasing demand as the price level of the starting materials goes down. Certain uses of these products such as the packaging of fruit, vegetables, other foods and perishable materials, to protect and prolong their usefulness during transportation, are of the utmost importance in our economic development. These chemical uses may require from 25,000-100,000 long tons of rubber annually. If these various miscellaneous uses for rubber are combined they offer an annual potential of from 63,250 to 191,000 long tons of rubber. Considering a prewar use of over 50,000 tons for miscellaneous purposes, these new possibilities amply justify the increases shown in this category.

The justification for the swing above the normal line for U. S. A. rubber consumption must apply with even greater force to the rest of the world. The rate will be governed by postwar stability, ability to process rubber and by the increase of industrialization. The projected curve for the next four years indicates the following consumption of rubber outside of this country:

CONSUMPTION OF RUBBER OUTSIDE U.S.A.—LONG TONS 1945 1946 1947 1948 400,000 400,000 600,000 700,000

The ability to process these amounts does not seem out of the question, in view of the 1937 and 1939 figures, when 560,000 and 509,000 long tons, respectively, were consumed. Due consideration is given to the partial destruction of rubber producing facilities, but it is believed that these can soon be repaired or replaced and any deficiency should be more than offset by the known large increases in processing capacities in England, Russia and South America.

The world requirements for rubber in the (assumed) postwar years are as follows: 1947—1,526,500 long tons; 1948—1,701,000 long tons.

In order to estimate the availability of rubber, we must consider the plantation situation. Of course, no one can say with certainty when the plantation areas will be recovered. Undoubtedly, steps will then be taken for their rapid rehabilitation. Even so, small native estates will be the first to produce, because of simple equipment. The reorganization of labor and replacement of equipment on large estates will be a difficult and tedious job. The attitude of the natives may be uncooperative and international disputes are not unlikely. It is expected, therefore,

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TABLE II—DESIGN AND PERFORMANCE FACTORS FOR 4000 HP POWERPLANTS WITH DIFFERENT CYLINDER NUMBERS

(200 psi bmep, 2750 fpm piston speed, 1.1 stroke/bore ratio)

z	V _h cu in.	eu in.	s in.	d in.	N/V hp/cu in.	(G/V) _m lb/cu in.	(G/N) _m ib/hp	rpm
30 32 35 36 42 45 48	224 204 178 171 136 120	6740 6528 6247 6156 5712 5420 5328	7.02 6.80 6.50 6.40 5.94 5.70 5.55	6.38 6.18 5.91 5.82 5.40 5.18 5.05	0.594 0.614 0.641 0.650 0.700 0.738 0.751	0.568 0.586 0.618 0.626 0.683 0.713	0.957 0.955 0.964 0.964 0.977 0.967	2350 2428 2540 2580 2780 2898 2978

Part Two

Part I appeared in the June 15th issue of AUTOMOTIVE and AVIATION INDUSTRIES

by increasing the number of cylinders, must be based essentially on firmly-established practice in the design of in-line and radial engines, the features of which will still remain recognizable in the new designs developed by increasing the number of banks or rows of cylinders. Typical features of the radial engine are:

- Radial arrangement of cylinders, with equal angular spacing.
- 2. Odd number of cylinders in each row, with a characteristic firing order.
- 3. Cylinder rows staggered by half the angular spacing, to promote cooling.
- Subdivision of the crankcase into segments or rings (not essential).

Further variations of the cylinder arrangement fall under the classification of in-line engines, which are characterized by cylinders in a straight line with (for the purpose of the present analysis) an even number of cylinders in each bank. In-line engines are classified

according to the number of cylinder banks as two-, three-, four-, six- and eight-bank; radial engines according to the number of cylinder rows, as four-, five-, or six-row. Further classification then is based on the total possible number of cylinders: 30, 32, 35, 36, 42, 45 and 48. A second classification is based on the number of crankshafts, which may be one, two, three or four, and on the shaft arrangement, whether parallel or in tandem. Fig. 16 is a key plan of possible cylinder arrangements. Only designs which hold practical possibilities are considered, which explains why a good many of the spaces are left blank.

The principal engine designs which have been incorporated in the key plan have been developed in characteristic dimensions to the extent necessary for their evaluation. The development principally aims at elucidating the crankshaft lay-

Cylinder

out, the paramount consideration being a low frontal area. Consequently, articulated connecting rods are avoided, and up to three rods are placed side-by-side on one crankpin, which is possible with narrow roller bearings and crankpins of sufficient diameter, the crankshafts necessarily being made heavier and more rigid than in conventional practice, because of the larger torque to be transmitted. The next problem is the development of a suitable transmission gear and propeller drive, from the points of view of weight and space. This having been settled, the overall dimensions of the powerplant can be estimated, due allowance being made for the blower, auxiliaries, and piping.

In the interest of standardization and unity of design, the following constants must be borne in mind:

TABLE III-LIQUID-COOLED AIRCRAFT POWERPLANTS OF 4000 HP.

(200 psi bmep, 2750 fpm piston speed, 1.1 stroke/bore ratio)

Line No.	Type Designation	Cylinder Number	Weight Lb	Specific Weight G/N	Frontal *Area F ₃ sq ft.	Hp/F ₃ N/F ₃	Length Lin.	Powerplan Volume Va cu ft.
1	1.3R12	36	4210	1.05	10.7	374	104	86
2	1.4R8	32	4010	1.00	13.5	296	83	81
3	1.6R6	36	3940	0.99	17.7	226	71	98
4	1.8R4	32	3920	0.98	19.8	202	59	
5	2n2R:8	32	4080	1.02	11.8	339	77	
6	2n2Rv8	32	4080	1.02	12.2	327	77	74
7	2n2R:12	48	4360	1.09	8.4	476	93	62
	2n2Rv12	48	4360	1.09	8.6	465	93	64
9	2n3R6	36	4010	1.00	16.1	248	65	85
10	2n3R8	48	4230	1.06	12.6	317	71	74
11	2n4R4	32	3920	0.98	28.0	154	53	105
12	2n4R6	48	4100	1.02	20.1	199	83	133
13	2h2R18	32	4340	1.08	6.4	625	150	77
14	2h2Rv#	32	4340	1.08	6.1	656	150	74
15	2h3R6	36	4185	1.05	10.7	374	126	109
16	2h3R8	48	4385	1.10	8.0	500	140	108
17	2h4R4	32	4010	1.02	13.5	296	100	108
18	2h4R6	48	4250	1.06	19.6	204	116	82
19	2h6R4	48	4185	1.05	15.1	265	75	125
20	3n2R6	36	4165	1.04	20.2	198	71	109
21	3n2R8	48	4120	1.03	14.9	268	77	82
22	4n2R4	32	4100	1.02	25.7	155	53	104
23	4n2R6	48	4320	1.02	17.7	226	83	116
24	4n/h2R4	32	4100	1.02	11.8	339	75	82
25	4n/h2R6	48	4385	1.10	8.4	476	110	75
26	4n/h3R4	48	4230	1.06	12.6	317	100	103
27	1.489	36	3940	0.98	17.7	226	57	77
28	1.557	35	3920	0.98	17.7	226	65	89
29	1.589	45	4010	1.00	15.1	265	83	98
30	1.655	30	3920	0.98	19.8	202	78	112
31	1.657	42	3965	0.99	16.1	248	89	113
32	2.259	36	3985	1.00	17.7	226	71	98
33	3.255	30	4030	1.01	19.7	203	99	153
34	3.257	42	4050	1.01	16.1	249	95	121

For liquid-cooled engines the spacing between cylinder axes is made 1.12 d; for radial engines, 1.3 d. The gears are designed for an assumed propeller speed of 1000 rpm. The frontal area is calculated from the simplest outline, including the necessary cowling for fuselage or wing mounting. The space required for the powerplant, which likewise is a design constant, is the product of this frontal area by a reduced length

others $(F_*, N/F_*, L$ and $V_{\tau})$ can be arrived at with a fair degree of accuracy from the drawings, or calculated somewhat less accurately from the mean values of the curves of Figs 1 and 3 (G and G/N). To make possible a full comparison between the designs, additional coefficients are required to represent the effect on total engine weight of such items as the type of cooling system, dimensions, number and arrangement

of cylinders and crankshafts, and dimensions of the transmission gear.

A complete comparative evaluation of the different engine types listed in the key plan will be possible only if, in addition to the easily-determined characteristics such as the weight/power ratio, power/frontal-area ratio, etc., numerical expressions can be found for other important design and performance factors.

The symbols in the squares of the key plan represent the frontal projection of the cylinder layout per crank-

shaft, the number of cylinders in line being noted alongside. In the type-code designation below the notation is as follows:

The first figure represents the number of crank-shafts.

Arrangement

for 4000 Hp.
Aircraft Engines

which takes account of the tapering of the nose cowling.

Tables III and IV give design and performance constants of various engine types. Certain values (N, p_e, c_m, s/d) are fixed in advance, while others (n, z, N/z, V_b, V, N/V, s_Id) can be accurately calculated by means of the performance formula, and still

Fig. 16—Key plan of layouts for 4000-hp powerplant

Chinder	Arrangement		In-Line									R	adia	ıls	
dino	Grouping	2		3		4		6		8		5			6
CA	Number	32	36	48	32	48	36	48	32	48	36	35	45	30	42
	kshaft Arrangement	4	1 112	6	2 × 8	6	¥6	6	4	6	**	28	29	30	31 **6
1	7		1.3812		1.4R8		1.6R6		1.8R4		1.459	1.557	1.559	1.655	1.657
2	Paralell	7	9	9	5 8 2n2R ₁ 8	8 2n2Rj12 7 112 2n2Ry12	9 + 6	10 8 2n3R8	11 ★ 2n4R4	12 ** 6 2n 4R6	2	2	2	2	2
		13 - 8 2h2Rr8 14 8 2h2Ry8	大。	16 8 2h3R8	17 14 2h4R4	18 X 6 2h4R6	5a	19 4 2h6R4	3a	3a	32 **2 2.259	9	9	3 b	36
3	Paralell	10	7	7	9	9	3n2R6	21 3n2R8	9	9	2	2	2	2	2
3	Tandem	1a'	1a	1a	1a	1a	1a	1a	1a	la	56	9	36	33 2 2 3.255	34 **2 3.257
4	Paralell	10	10	10	7	7	9	9	22 4 4 4 1 2 1 4 1	23 6 4n2R6	2	2	2	2	2
,	Twin paralell and tandem	7	9	9	24 4 4n/n2R4	25 6 4n/h2R6	5a	26 4 4n/h3R4	3a	3a	2	2	2	2	2

TABLE IV-AIR-COOLED POWERPLANTS OF 4000 HP.

(200 psi bmep, 2750 fpm piston speed, 1.1 stroke/bore ratio)

Line No.	Type Designation	Cylinder Number	Weight Lb.	Specific Weight Lb/Hp	Frontal Area F ₃ oq ft.	Hp/Fs	Length In.	Powerplan Volume V: cu ft.
1	1.3R12	36	4340	1.085	10.7	374	114	95
2	1.4R8	32	4140	1.035	13.5	296	91	89
3	1.6R6	36	4050	1.012	17.7	226	77	107
A	1.8R4	32	4030	1.007	19.7	203	63	96
5	2n2R18	32	4185	1.046	11.8	339	85	80
	2n2Rv8	32	4185	1.046	12.2	328	85	82
7	2n2R112	48	4495	1.124	8.4	477	102	69
8	2n2Rv12	48	4495	1.124	8.6	466	102	71
9	2n3R6	36	4120	1.030	16.1	249	71	92
10	2n3R8	48	4360	1.090	12.6	318	77	77
11	2n4R4	32	4030	1.007	26.0	154	57	114
12	2n4R6	48	4205	1.051	20.1	199	87	139
13	2h2R18	32	4470	1.117	6.5	617	165	85
15	2h3R6	36	4315	1.079	10.7	374	138	119
16	2n3R8	48	4515	1.129	8.0	500	152	97
17	2h4R4	32	4140	1.035	13.5	296	108	117
18	2h4R6	48	4385	1.096	8.8	455	126	90
19	2h6R4	48	4305	1.079	15.1	265		
20	3n2R6	36	4270	1.067	20.2	198	110 77	132
21	3n2R8	48	4450	1,112	15.0	267	83	118 97
22	4n2R4	32	4205	1.051	25.7	155	57	
23	4n2R6	48	4450	1,112	17.7	226	87	112
24	4n/h2R4	32	4205					124
24			4515	1.051	11.8	339	102	97
25 26	4n/h2R6	48		1.129	8.4	476	120	81
20	4n/h3R4	48	4360	1.090	12.6	317	104	106
30	1.655	30	4050	1.012	19.7	203	79	121
32	2.239	36	4095	1.024	17.5	228	75	104
33	3.255	30	4140	1.035	19.7	203	104	163

The next letter, the crankshaft layout, in parallel (n) or in tandem (h).

The second figure, the number of banks or rows per crankshaft.

The following letter, the cylinder grouping: R, bank-in line; S, row-radial.

The next index letter (subscript), the arrangement of the cylinders in V or I form.

The third figure, the number of cylinders per bank or row.

The figures in the squares without a type symbol indicate the reasons for the impracticability or limited applicability of the variant in question, as follows:

- 1a. Not more than two in-line engines in tandem.
- Not more than three twin-row radial engines in tandem.
- 2. No radial engines in parallel (side by side).
- 3a. Not less than four crank throws for in-line engines.
- 3b. Not less than two (but not three) crank throws for radial engines.
- 4. Not more than 12 crank throws per shaft.
- 5a. Even number of cylinders per bank. (excepting Nos. 10 and 14).
- 5b. Odd number of cylinders per row (radial).
- 6. Not more than 45 cylinders per crankshaft.
- Not less than two cylinder banks per crankshaft.
- 8. Not more than 16 cylinders in line.
- No unsymmetrical crankshaft, crank throw or cylinder arrangement.
- 10. Variant leads to an absurdity.

Comparing the various designs included in the key plan on the bases of weight, frontal area, reliability, crankshaft layout with regard to vibrational characteristics, suitability to wing or fuselage mounting, accessibility and servicing convenience, a balance of advantages seems to be offered by the liquidcooled 32-cylinder design No. 5 (2n2R₁8 = two parallel crankshafts each with two cylinder banks in I form; opposed-cylinder layout with eight cylinders per bank. It represents the most promising combination in all respects, and has a particularly small frontal area. though freedom from knock is doubtful, owing to the large cylinder size of 205 cu in. Owing to the high specific output, smooth operation on standard fuels is difficult with all engines of 180 cu in. displacement per cylinder and over, but can be assured by using highoctane fuel.

Knock-free operating on standard fuels seems to be as-

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sured by the almost equally-satisfactory 36-cylinder design No. 9 (2n3Rb = two parallel crankshafts with three banks of six cylinders each), with a cylinder size of 165 cu. in. Both designs owe their qualities principally to the twin crankshaft layout, which makes for reliability and simplicity in the propeller drive, resulting in a low unit weight.

If a single crankshaft is to be used, designs Nos. 2 and 3 deserve most consideration (14 R 8 = one crankshaft with four banks of eight cylinders each; 16 R 6 = one crankshaft with six banks of six cylinders each). No. 2, with the smaller frontal area, again has a comparatively-large cylinder size-205 cu in. No. 3, with a cylinder size of 165 cu in., has a larger frontal area. Assuming this latter factor to be of minor importance, as where the engine is to be mounted in an airframe of correspondingly large dimensions, and considering that in large multiengined planes the individual engine unit does not need such a high degree of reliability, particularly with a twin-shaft layout, the optimum design for a large powerplant appears to be the 36-cylinder one with six banks of six cylinders each and a cylinder size of 165 cu in. The 32-cylinder design with twin shafts, each with two eight-cylinder banks, would appear to be more particularly adapted to small single-engine very fast aircraft.

Of the air-cooled types, the more accessible design No. 11 (2n4R4 = two crankshafts each with four banks of four cylinders each) appears to take first place, followed by Nos. 9 and 5. The lower weight of No. 11 tends to balance its larger frontal area. Apparently, so far as a theoretical evaluation can show, air-cooling is unsuitable for all designs, unless some form of fan cooling (forced draught) can be used.

Almost all of the designs discussed have good mechanical balance, which is due to the large number of cylinders and the multiple symmetry of the layouts.

Design of Needle Bearings Eliminates Stress Concentrations







TYPE DC DC (Inner Race)

TYPE AT

PULL COMPLEMENT OF NEEDLE ROLLERS PROVIDES MANY LINEAR INCHES OF CONTACT; DISTRIBUTES LOAD OVER LARGER AREA

Elimination of stress concentrations is one of the outstanding features of all Torrington Needle Bearings which stems from their basic design principle—the use of a full complement of small diameter needle rollers.

In operation, this means that the load on the Needle Bearing is widely distributed over a comparatively large number of rollers, and each in turn provides "line" contact with inner and outer race. As illustrated in the accompanying diagram, a large number of needle rollers are always within the "load zone" as the rollers revolve around the shaft. Thus the load is evenly distributed and the full capacity* of the bearing may be utilized without fear of concentration of stresses at any given point or on any single component of the bearing. As long as the design load is within the rated capacity of the bearing, the dangers of rapid or uneven wear, of stress fatigue, or of brinelling bearing parts are virtually eliminated.

This feature, coupled with the efficient lubrication of rollers, made possible by the design of the outer raceway which serves to hold the lubricant within



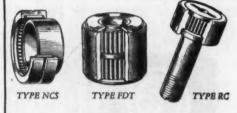
LOAD ZONE

Note how the load is distributed. The large number, of the needle rollers which are within the theoretical "load zone" provide many linear inches of contact with bearing surfaces.

the bearing, insures maintenance-free operation and long service life.

For All Design Requirements.

From the several types of Torrington Needle Bearings available, the design engineer may select the one best suited to the requirements of a particular application. Load, speed, service conditions, design limitations and cost considerations can be met with full confidence that the right Torrington Needle Bearing, properly installed, will provide long bearing life and freedom from service attention. Let our engineering department work with you in selecting the correct type Needle Bearing for your application. Experience in



layout and design of hundreds of different applications will enable our engineers to give practical assistance in meeting your design requirements. More information on the types and sizes of Torrington Needle Bearings together with a more complete description of the advantages of these compact, anti-friction units, will be found in our Catalog No. 30-A available on request. Send for your copy.

*Utilization of full or theoretical capacity of Needle Bearings is dependent upon proper shaft hardness, correct installation and other factors. See Torrington Needle Bearing Catalog for more complete information.

THE TORRINGTON COMPANY

Established 1866 • Torrington, Conn. • South Bend 21. Ind.
"Makers of Needle Bearings and Needle Bearing Rollers"

New York Boston Philadelphia

New York
Detroit
San Francisco

Boston Cleveland Chicage

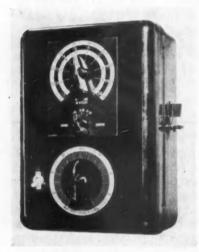
Philadelphia Seattle Los Angelas London, England



TORRINGTON NEEDLE BEARINGS

New Production Equipment

A TEMPERING attachment, for use with G-E synchronous spot-welding controls which incorporate the phase-shift method of heat control, has been placed on the market by the General Electric Company, Schenectady, N. Y. The new auxiliary control is said to be particularly suitable for use in the spot welding of air-hardenable steels,



G-E tempering attachment

since it permits tempering the weld while the work is still in the machine, thus reducing hardness and increasing ductility.

The attachment consists of a heatcontrol and a time-control adjuster for tempering, and the relays which automatically transfer the additional heatand-time adjustment from the spotwelding control with which the attachment is being used.

The new attachment is enclosed in a metal case designed for wall mounting. The calibrated adjustment dials are mounted on the hinged door of this case, together with an ON-OFF switch for preventing the relays from being energized when ordinary spot or pulsation welding is being done.

A METHOD of uniformly and adhesively bonding chrome to the full thread form on a thread gage, with the trade name of "Precisionplate," is announced by The Sheffield Corporation, Dayton, Ohio. This special process enables the adhesion, the toughness and the thickness of the chromium to be controlled to a very fine degree of precision. The chromium is said to be bonded to the steel with such adhesion that "Precisionplate" plugs are ex-

traordinarily chip-resistant. A microphoto (100-1) shows the chrome is relatively uniform from the crest, over the pitch diameter, to the root, making it possible for the gage to give a more accurate check throughout its entire life.

Among the advantages claimed for "Precisionplate" is the increased resistance to corrosion caused by handling or the atmosphere, as well as to scoring, marring, and other damage due to rough handling. "Precisionplate" thread plugs are stocked in standard sizes and have an accuracy of Class X tolerance in lead, angle, and pitch diameter. Special "Precisionplate" plugs can be made to order.

THE manufacture of plug and thread gages from the hardest, most wear resistant grade of Stellite alloy has now been made an accomplished fact by N. A. Woodworth Co., Detroit.

Through close cooperation with Haynes-Stellite Co., development of the casting form progressed into practical blank sizes up to and including 1½ in. diameter to the American Gage Design Standard. Cylindrical and thread plugs up to and including ¾-in. O.D. are made solid, both gage member and shank being cast solid Stellite.

In order to conserve Stellite material and to reduce weight, gages above 4-in. diameter and including 1½ in. are made of the bushing type with a standard tapered steel shank brazed to the Stellite bushings, resulting in a practical and economical gage of other-



Woodworth Stellite gage

wise standard American Gage Design Standard design.

Cylindrical and thread plugs over 1½ in. and including 4 in. of the American Gage Design trilock design will be made to order; blanks for these sizes at present are not carried in stock. These gages will be made of cast Stellite alloy bushings with aluminum insert. Gages of this design have the advantage of lighter weight than a steel gage of the same size.

A NEW rocker arm spot welder for production sheet metal work has been brought out by Sciaky Bros., Chicago, Ill. This relatively small unit employs features usually found only on

larger machines. The upper arm is equipped with heavy duty roller bearings at the fulcrum point. The pressure cylinder contains a rubber bumper to eliminate hammering. The unit is entirely self-contained. Electronic controls and contactor are mounted in a hinged cabinet with dials and switches convenient to the operator. Current interruption may be either magnetic or by ignitron tubes. Operation is fully



Sciaky rocker arm spot welder

automatic with controls for welding heat, duration of current, cool period and off period.

The welding is rated 30 kva at 50 per cent duty cycle with capacity on clean mild steel of from two thicknesses of .016 in. up to and including two thicknesses of .080 in. on stainless steel up to a maximum of .040 in. plus .040 in. Speed on two thicknesses of .032 in. pickled mild steel is 180 spots per minute. Electrode pressure at 24 in. throat depth is 1000 lb.

An improved toggle-action "C" clamp which holds a wide range of work has recently been developed by Detroit Stamping Company, Detroit, Mich.

Two adjustable clamping spindles grip the work at any selected point, thus permitting clamping over double angles and other irregular shapes. The clamping gap is readily adjustable to any thickness within the clamp range. Each spindle is locked into its place and remains at that setting until manually re-adjusted.

Quick clamping and release are effected by rapid toggle action. Upon release the entire upper portion of clamp swings clear of the work.

Other features of this clamp are these: Body is a malleable iron casting, the threaded spindles are copper coated against welding spatter, and links and handle are plated against corrosion.

By changing location of retaining (Turn to page 68, please)

J



HE lathes in your shop may be only a few years old—yet may be as worn or obsolete as machines of half a century ago. For in many shops today, the terrific strain of continuous war production has reduced the economic life of a lathe to a fraction of its original capacity. With greater production still the objective in nearly every plant, lathes incapable of

top performance should be replaced with new and improved models.

If the lathes in your shop were purchased before the war, check them with the new, more versatile and productive lathes Lodge & Shipley offers. These powerful, high - efficiency tools will give your work the benefit of every worthwhile improve-

ment devised in 52 years of specialized lathe experience. For a practical demonstration of how an L & S Lathe pays for itself in increased production and lowered costs, call on Lodge & Shipley Engineers.

PREPARE FOR THE COMING BATTLE OF MARKETS!

In the postwar period, lower costs will be more than ever a determining factor in the salability of your products. This L & S Manufacturing Lathe, for example, will reduce your production costs on a wide variety of work. In addition to having all the features of an engine lathe, it performs many other types of work, rivals an automatic in output and accuracy. Various automatic and manual controls simplify tasks of the operator, effecting unusual time savings on both production and singlepiece jobs. For complete details on various L & S Manufacturing Lathes write for Bulletin No. 615 MO.



ENGINE AUTOMATIC TOOL ROOM OIL COUNTRY LATHES

THE TODGE & THIPLEY MACHINE TOOL CO.

CINCINNATI 25, OHIO, U.S.A.



New Products for Aircraft

Enclosure for Aircraft Control Devices

A new standard dust-tight enclosure for housing combinations of aircraft control devices has been announced by the General Electric Company, Schenectady, N. Y. This enclosure accommodates various G-E aircraft control relays and contactors with ratings up to and including the G-E 100-amp aircraft contactor.

Completely gasketed, the enclosure is



G-E aircraft control housing

made of aluminum, with cast aluminum end frames. Hence it is light in weight, yet provides full mechanical protection to the devices housed in it.

A self-locking latch permits the removal of the cover of the enclosure in a vertical direction without disconnecting wires or the use of tools. This latch also has a provision for wire-locking the enclosure. In addition, the end plates are adaptable for various sizes "AN" connectors or terminal posts.

This enclosure is available in various lengths up to 19 in., over-all.

Lightweight Material for Soundproofing Aircraft

Glass fibers weighing only four onehundredths of a pound per square foot when bound with a thermosetting resin and formed into half-inch-thick sheets, are being used in the cabins and flight decks of certain types of U. S. war planes to provide insulation against cold and to deaden fatigue-causing sound.

The fibrous glass sheets are incombustible and are said to be the lightest inorganic material commercially available for the sound-proofing and insulation of planes. Another factor is that the sheets gain less than one per cent of their own weight from moisture in the air, when subjected to temperatures of 125 F and to 90 per cent relatively humidity. They, therefore, do not cause the dead-load of the plane to increase when it is flying through

clouds or other humid atmospheres.

The fibrous glass sheets, known as Fiberglas Type XM-PF, are manufactured by Owens-Corning Fiberglas Corporation, Toledo, Ohio.

New Types of Plastic Lenses

New types of plastic lenses now direct the beams which guide night-flying pilots to safe landings. Injection-molded of "Lucite" methyl methacrylate resin, the lenses provide good weather resistance and dimensional stability as well as a sharp reduction in weight compared with the former lenses. The use of "Lucite" makes possible a lens design which almost triples illumination from the same light source. The lenses of "Lucite" also are less subject to breakage, both in transit and in actual use.

They are a feature of the lighting

Anti-Ice Boot for Airplane Propellers

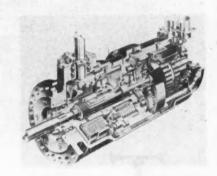


Goodyear Tire & Rubber Co., Akron, Ohio, makes the anti-ice boot, pictured above, of a special synthetic rubber which conducts electricity. Wires along the border of the boot carry current from a small generator in the propeller hub, thus eliminating the possibility of ice forming on the propeller.

equipment now used by the Armed Services for training fliers and for marking temporary fields when the swiftness of the advance outruns the ability to establish modern radio directional beams so essential to the safety of ships and pilots.

Eclipse Electric Actuators

Eclipse-Pioneer Division of Bendix Aviation Corporation, Teterboro, N. J., has designed electric actuators for applications requiring electric motor



Typical Eclipse concentric actuator

driven gear reduction units to retract and lower landing gear, open and close bomb bay doors, control wing flaps and other similar functions.

The electric actuators are available in concentric and right-angle design to provide maximum compactness and clearance, depending on the characteristics of the installation under consideration.

Design features include an automatic compensating torque limiting device in the form of a multiply disc clutch which protects reduction gearing and motor in the event of undue loading.

A special magnetic equalizing clutch prevents over-running and jamming. This feature also facilitates hand operation on models so equipped by eliminating resistance of gear train and

Explosion-proof motors, available in certain models are completely enclosed against explosive vapors, as well as mud and dirt. Motors are available for 24-volt DC operation.

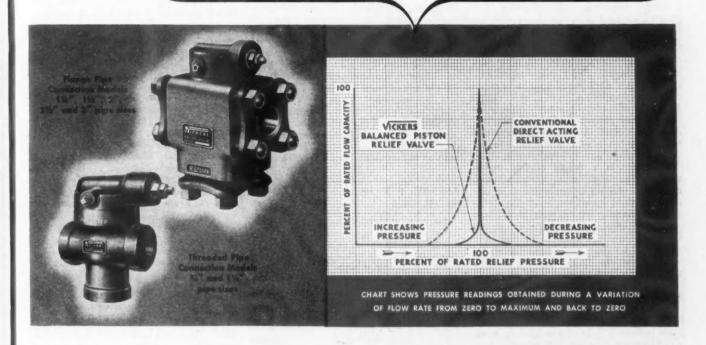
Goodrich Bladder-type Rubber Fuel Cells

Bladder-type rubber fuel cells for non-combatant aircraft are a recent development of the B. F. Goodrich Company, Akron, Ohio. These rubber fuel cells are much simpler and lighter than the combat type, being actually rubber bags or bladders made to fit accurately into the spaces between wing supports.

(Turn to page 92, please)

MORE ACCURATE

HYDRAULIC PRESSURE CONTROL



VICKERS

Balanced Piston Type

RELIEF

As indicated by the chart above, Vickers Balanced Piston Type Relief Valves have a negligible pressure variation throughout their capacity range. In these valves a hydraulically loaded and balanced piston takes the place of the customary spring-loaded directacting relief mechanism. This means more sensitive operation as well as greater accuracy throughout the wide pressure range.

This accuracy of control prevents pressure override when sudden changes in pressure occur in the hydraulic system. Compact design, longer operating life, installation directly in the pressure line, quiet operation, and simple adjustment are other advantages of these Vickers Balanced Piston Relief Valves. See Bulletin 38-3 for complete information.

Vickers Application Engineers will gladly discuss with you how Vickers Hydromotive Controls can be used to your advantage.

VICKERS Incorporated

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Application Engineering Offices: CHICAGO • CLEVELAND • DETROIT • LOS ANGELES NEWARK • PHILADELPHIA • ROCHESTER • ROCKFORD • TULSA • WORCESTER

Representative of More than 5,000 Standardized Vickers Units for Every Hydraulic Power and Control Function



CONSTANT DELIVERY



FLUID



DIRECTIONA



VOLUME



PRESSUR



CONTRO



VARIABLE DEUVER

New Products

Four New Westinghouse Plastic Developments

Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., has recently announced four new plastic developments—a new plastic called Fosterite, a unique method of fashioning plastics into complex shapes, another technique that enables engineers to stretch hot plastic material into intricate forms, and a synthetic shellac.

Fosterite is a tough plastic which seals radar and radio parts against moisture. In its liquid state it is almost as fluid as water, and fills completely every space in electrical windings. A special-coating form of the material can be applied to the apparatus, leaving no gaps through which moisture could seep. Fosterite requires no liquid solvent which would evaporate during the heating process and cause tiny cracks to appear.

Called "preformed plastic" because it is shaped roughly like its finished form before it is finally molded by heat and pressure, another new material has a tensile strength of 16,000 psi, and weighs only one-third to one-half as much as the aluminum alloys used in a ir plane construction. Wood fibres, locked together with a varnish-like resin, give the finished material its strength.

A technique for stretching hot plastic material into complicated shapes is made possible by the use of Micarta 444, the extreme formability of which distinguishes it from the other members of a family of established synthetic materials known as Micarta. Flat sheets of Micarta 444, after being heated to the softening point, may be formed into intricate shapes never before possible with laminated plastics.

Still another development by Westinghouse is a synthetic resin to replace shellac, a highly essential material for some types of electrical insulation. Natural shellac is made by small insects from the sap of several kinds of trees and consequently contains many impurities. The new synthetic product eliminates these impurities.

Special-Purpose Storage Batteries

The Willard Storage Battery Company, Cleveland, Ohio, has developed a number of storage batteries to fill special needs of the Armed Forces. All of these new batteries have polystyrene plastic containers which are stronger than hard rubber and lighter than glass. Most of them use Fibrite, an

insulation developed by Willard from non-critical materials, which is said to so effectively retard shedding of active material from the plates that no sediment space is necessary at the bottom of the containers. Willard Fibrite insulation absorbs 90 per cent of the electrolite, and complete non-spill construction is achieved by extending the walls of the vent tube downward in such a manner as to trap the 10 per cent of the solution remaining free.

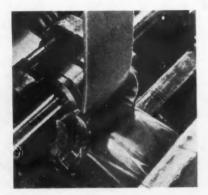
Formex Wire in Small Sizes

Formex ribbon-rectangular magnet wire available in shapes as thin as 0.004 in. is now in production at the General Electric Company, Schenectady, N. Y. The new Formex, being made for the war program, in one-fourth the size heretofore considered the low limit for thickness of this wire.

Smooth, strong, flexible, and able to withstand high-speed winding without damage to insulation, the new Formex ribbon-rectangular wire offers many application possibilities to producers of electronic devices and other electric components.

Belting Cemented with Celluloid Plastic Foil

Graton & Knight Company, Worcester, Mass., is manufacturing belts by a patened process which hinges on the use of Celluloid plastic foil. The foil passes through a solvent bath and is then fed continuously between two single plies of leather, which together pass between sets of rubber pressure rolls and are then wound on a drying drum while under normal belt drive



Celluloid plastic foil being fed between plies of leather to make Graton & Knight belting

operating tension. The result is belting which is said to have extremely high adhesive strength. The Celluloid plastic foil used in this process is a product of the Celanese Celluloid Corporation, New York, N. Y.

Additions to Torrington Line of Fan Blades

Several new sizes of propeller fan blades have been added to the line of The Torrington Manufacturing Company, Torrington, Conn.

To the standard series, a 27 deg. pitch has been added in the 10-in. and 12-in. diameters. There is a new P-1027 in the pressure type fans or "P Series."

An addition has taken place in the Autocrat fans, for use in automobile heaters and similar applications. The size range in this type has now been extended with development of 8-in. and 10-in. diameters, each with five blades. A new 5½-in. five-blade, made special for some time, has now been listed as a standard product in the Autocratline.

Cerex, a New Thermoplastic

Monsanto Chemical Company, St. Louis, Mo., has announced a new thermoplastic, known as Cerex, which is a co-polymer containing the elements carbon, hydrogen and nitrogen. These three elements may be combined in various forms to give various characteristics but the present war development is concentrated on Cerex, X214.

Cerex X214 is dimensionally stable with a minimum ASTM heat distortion point over the boiling point of water. Water absorption gain on ASTM test is 0.3 per cent. Tests, run on pilot plant material, indicate that flexural strength runs around 13,000 psi.

The dielectric strength of the material is over 500 volts per mil. Cerex is said to have unusually good resistance to acids. The material now being produced has a transparent amber natural color. Color possibilities in molding compounds are somewhat limited, although a range of transparent, translucent and opaque colors can be obtained. In flamability tests, the material is rated as slow burning.

Improved Vinyl Tubing

A new vinyl tubing, which is said to have better heat endurance characteristics, resistance to oil embrittlement, and resistance to gasoline-benzol than conventional tubings, is being produced commercially by The National Varnished Products Corporation, Woodbridge, N. J. Designated as Natvar 400 Series, this new tubing is available on the same priority basis as standard vinyl tubings.

(Turn to page 67, please)



It is reported that:

The world's most powerful electric motor has recently been completed. Developing 7,000 horse-power at only 25 r.p.m., it is said to be capable of lifting an entire four stack destroyer at the rate of 200 feet per minute.

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get ready with CONE for tomorrow

A new resin dip for small metal parts feels like rubber, protects the part, strips easily by hand and may be re-used.

get ready with CONE for tomorrow

A new invention consists of a panel that hangs over a bed and is a source of radiant energy. Properly adjusted to the sleeper's metabolism and length of slumber, it is expected to give him the equivalent of a full night's sleep in as little as two hours.

get ready with CONE for tomorrow

The rare metal, indium, is being used as a tarnish-proof plating for gold and silver and is being used as an alloy in bearing metal and solder.

get ready with CONE for tomorrow

A new chemical does most of the work of the dangerous hydrofluoric acid without danger to the human skin.

get ready with CONE for tomorrow

The new plastic-coated fabrics will be water-proof and abrasion-resistant and may be flexed for a long time before cracking. They will be useful materials for baby carriages, auto tops, furniture, bus seats, shoe tips, raincoats, luggage, shower curtains and handbags.

get ready with CONE for tomorrow

Even the high-pressure cylinders used to hold compressed gases are now being made by stamping and drawing.

get ready with CONE for tomorrow

A colored surface .0001 inch thick, applied to the surfaces of gages does not affect their accuracy, but warns of wear by a change in color.

A national producer's council hopes to reduce the cost of home building by 20% by promoting more modern building codes and labor regulations.

get ready with CONE for tomorrow

The by-products of sawdust have become so valuable that some sawmills are using coal for fuel.

get ready with GONE for tomorrow

A prominent scientist states that it may take twenty years to utilize fully the scientific discoveries made since Pearl Harbor.

get ready with CONE for tomorrow

A synthetic shellac made from corn is expected to permanently replace the natural product which is made from the secretions of an insect found in India.

A large manufacturer of farm machinery proposes to enter the peace-time farm market with a line of refrigerators and cold storage lockers.

get ready with CONE for tomorrow

A new low-temperature grease permits aerial cameras to operate at temperatures as low as 100 degrees below zero.

get ready with CONE for tomorrow

A French automobile manufacturer expects to make a small, economical car for the American postwar market.

get ready with CONE for tomorrow

A maker of paper parachutes, for dropping supplies to troops, expects to continue their manufacture after the war for use in the air delivery of mail and light-weight express.

get ready with CONE for tomorrow

The world's shortest firing range, only twenty-two feet long, duplicates the air pressure and temperature of the stratosphere.



JOSE-CHAFTEF / TETTOM BY JAMES M. SESSIONS

Revised Armament Program Again Calls for More Tanks

Increase in Heavy Truck Output Adds to Pressure on Steel Mills. Demand Continues for Shell Steel

By W. C. Hirsch

War front developments are again focusing attention on the metal needs of the armed forces with pressure chiefly on billet capacity and forging equipment for production of primary

shell steel material.

Cheered as the metal market was by WPB Chairman Donald M. Nelson's outline of steps to facilitate reconversion, attention is focused on the immediate needs of the armed forces, which is as Mr. Nelson wishes it to be. Pressure continues most severe on billet capacity and forging equipment for making primary sheet steel. Step-ping up of the production of tanks is one of the "musts" in the revised armament program and plate mills are straining their facilities to the utmost to meet the needs of the armed forces. An increase in heavy motor truck output is under way and adds to the pressure. Mr. Nelson's reiteration of the well known fact that the supply of the light metals-aluminum and magnesium-is abundant, is directing increased attention to the necessity of building up their potential peace mar-From the Operating Committee on Aircraft Material Conservation comes a directive repeating admonition to use National Emergency aircraft steel wherever possible, but revising in the accompanying Army - Navy Aeronautical Specifications restrictions of the molybdenum content, improved availability of molybdenum making it no longer necessary to unduly lower molybdenum content. In re-estimating the supply of chromium for the making of stainless steel, WPB officials have again found it necessary to point out that no relaxation of regulations against use of chromium can be expected in the immediate future. Regulations covering alloy steel tubing have been modified. Users, who are eligible to receive alloy steel tubing other than airframe and engine types, are permitted to exceed their quotas for a 60-day period by 5 to 10 tons, according to size. When they have worked up this supply, they must again hold their stock to within the prescribed inventory limits. The possibility, if not probability, of growing production losses as the result of much steel mill

equipment being urgently in need of overhauling figures prominently in recent releases of the Iron and Steel Industry Advisory Committee and to this potential cause of output shrinkage must be added continuing difficulities in maintaining industrial peace in the face of unreasonable union demands.

Responding to the demand for a regrouping of specific tin content solders, WPB has placed the automotive radiator industry on an average tin content per unit basis. These averages are in line with prevailing practices and will entail the use of no more tin per unit than is at present used. Subject to the customary certification, high-tin babbitt is permitted for use in motor trucks and tractors.

The Inter-American Magazine, in its current issue, voices the opinion that because of the destruction of much tin-mining equipment in the East,

Bolivia will play a major role as a supplier of tin for at least five years after the end of the war, but production costs will eventually have to be brought down sharply because at 60 cents a pound the invitation to the Orient cheap labor market would speedily overcome all obstacles and again dominate the situation. Conditions in Bolivia continue to improve. The New York trade expects an early visit from Mauricio Hochschild, who was reported a few days ago to have been liberated from a Bolivian prison and who is the most important factor in the Bolivian mining industry, his holdings being exceeded only by those of Consolidated Patino Mines & Enternrises.

A strike of 30,000 mine workers in Mexico involving nearly a hundred mining companies, many of them American-owned, has adversely affected the supply of copper, zinc and lead. The Mexican miners are aiming at compelling OPA to sanction higher prices for these metals, so that the increases in their wages, which they seek, would come out of the American taxpayers' pocket, rather than out of that of their employers. There is considerable unrest in other South American metal mining countries as the result of what happened in Mexico.

Automotive Companies Making Parts and Engines for B-29

Dodge-Chicago Plant Is Building Most of the Wright 2200 Hp Engines That Power the Big Bombing Planes

Numerous automotive companies are engaged in the manufacture of airframe parts and engines for the B-29 Superfortress bombers which staged their initial raid on Japan in mid-June. Fisher Body Division of GM, Chrysler Corp., Hudson, Briggs and Murray Corp. of America all produce airframe sections, while Chrysler's huge Dodge-Chicago plant makes a majority of the Wright 2,200-hp, engines that power the big Boeing-designed bombers. Eight Fisher Body plants at Cleveland, Detroit, Lansing and Grand Rapids are turning out 12 major parts for the B-29, including ailerons, outer wings, stabilizers, elevators and rudders.

The entire nose section for the Superfortress is being made by Chrysler's DeSoto Division. Three miles of wiring and a mile of tubing are installed in the nose sections. DeSoto also makes the leading edge for the wings and the

The changeover to engine cowling. B-29 parts from the B-26, which previously was assembled by DeSoto, began last September. Plymouth, Dodge and Chrysler divisions also are supplying DeSoto with parts for airframe assembly operations. Briggs has been working on B-29 airframe parts for more than a year, producing wing flaps, tunets, bomb bay, landing wheel and nose wheel doors. The company also is preparing to manufacture the stabilizer and dorsal fin. Hudson received a contract in July, 1943, to make rear fuselage and wing sections for the Superfortress. The first B-29 section was shipped in April only 19 days after the last B-26 fuselage section came off the assembly line. Murray Corp. makes outer wing tips for the B-29.

Chrysler was asked to build the 2,200hp. Wright engines for the B-29 Jan. 2, 1942. Ground for the first of 19 build-

Let Us Help You Improve Your Products — Reduce Fabricating Costs

.. with Uniform, Easy-to-Use Carpenter Stainless

Start now to put the advantages of Carpenter Stainless Steels to work in your products corrosion resistance, high strength/weight ratio, fatigue resistance, special physicals. You'll find Carpenter Stainless Steels cost less to use because they are easier to use. Soft and ductile Carpenter Stainless Strip

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blanks cleanly and forms easily. And the uniform qualities of Carpenter Free-Machining Stainless makes possible better finishes, faster cutting speeds, fewer rejects.

Here are some of the many ways in which Carpenter Stainless Steels are helping other Stainless users lick their specialized problems.

1 Mass-Production Possible

These aircraft gear segments had to be machined to .0005" tolerances. Mass production of these parts became possible when the manufacturer went to Carpenter Free-Machining Stainless #5 (Type 416).

1 Free-Acting for Life

Here in the valve stem of a heavy gauge valve, Free-Machining Stainless #5 (Type 416) provides the positive corrosion resistance and non-galling properties that assure long, trouble-free service life. Smooth-acting parts like these can be economically produced from Carpenter Stainless #5 and #8 bar stock.

1 Stops Costly Rejects

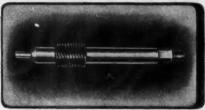
The problem of these grommets splitting around the edges of the inside holes was completely eliminated when Carpenter Stainless #6 (Type 430) was used on the job. This is typical of the way easy-working Stainless Steels banish fabrication headaches and help keep production costs in line.

1 Light and Extra Strong

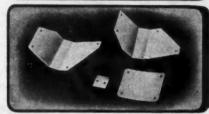
In these Naval ordnance parts, Carpenter Stainless #6 (Type 430) combines corrosion resistance with strength, rigidity and light weight. And faster fabricating of these parts is possible too, thanks to the uniform temper and high ductility of this Stainless Steel.

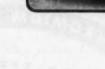
If you would like further information on these Stainless Steels write for our 98-page book "Working Data for Carpenter Stainless Steels". For personal assistance in the shop call in your nearby Carpenter representative.











The Carpenter Steel Company - 103 W. Bern Street - Reading, Pa.

Carpenter STAINLESS STEELS



BRANCHES AT

Chicago, Cleveland, Detroit, Hartford, St. Louis, Indianapolis, New York, Philadelphia Strength
Rigidity
Meat Resistance
Corrosion Resistance
Longer Product Life
Sales Appeal

WORKING DATA

ings that comprise the Dodge-Chicago plant was broken June 4, 1942, and the first production engines were shipped to the Army Air Forces 19 months later, in January, 1944. At its present production rate the plant is using 1,500 tons of aluminum, 500 tons of magnesium and 1,500 tons of steel per month. The plant has its own magnesium and aluminum foundries, both the largest of their kind in the U.S. There are 50 test cells for trying out the engines. The Wright engine itself is a 4-cycle, 18-cyl. type with bore of 6.125 in., stroke of 6.312 in. and total displacement of 3,348 cu. in. Takeoff hp. is 2,200.

Fact-Finding Panel of National WLB Sifts Foremen's Grievances

Foremen's authority is circumvented and often nullified by the UAW-CIO, it was brought out in testimony before the special fact-finding panel of the National WLB which is holding hearings in Detroit to inquire into grievances of the foremen preparatory to making recommendations to the WLB to prevent further interruption of war production such as that which closed

14 Detroit plants and made 55,000 workers idle last May. Dr. Sumner H. Slichter, economics professor at Harvard, is chairman of the panel, whose other members are William Spohn, Madison, Wis., attorney, and Robert D. Calkins, dean of the school of business at Columbia University. Foremen's complaints against 13 companies are involved in the case, eight of them in Michigan. The latter are Chrysler, Briggs, Murray Corp., Packard, Hudson, Gar Wood Industries, Bohn Aluminum & Brass Corp. at Adrian and Aeronautical Products Corp.

A foreman from Packard said that production workers who are protected by the UAW-CIO have their own way in grievance matters and related the incident of an employe who three times was found shooting dice or sleeping on the job, but could not be fired because the union defended him. His punishment was a three-day suspension. A Hudson foreman testified that company foremen are unable to make union stewards work unless the latter are directed to do so by the chief steward. He said the stewards just say they are on union business, but the company holds this against the

Answering charges of the Foremen's Association of America, which is representing the foremen at the hearing, that in many instances supervisory employes are paid less than those working under them, a management spokesman said that 4,407 foremen at Chrysler, Briggs, Packard and Murray plants average 50 per cent more gross weekly and monthly pay than the average hourly rated employes that they direct. W. D. Robinson, vice-president of Briggs, said that a survey of 1,769 supervisory workers in eight Briggs plants showed the differential between foremen and hourly rated workers to be 44 per cent based on a 40-hour week and 65 per cent when the actual earnings are computed. Average monthly pay for foremen on a 40-hour week is \$284 compared with \$196 for hourly rated workers. However, average monthly earnings including overtime is \$416 for foremen compared with \$251 for hourly rated employes.

The FAA presented the case of foremen at the DeSoto-Wyoming plant of Chrysler Corp. who received annual wages of \$2,900 in 1942 while stock chasers working under them were paid between \$3,584 and \$3,970 and the general foreman of the department made only \$3,593. Other complaints of the foremen include lack of seniority provisions resulting in unfair promotions, demotions and discharges, lack of effective grievance procedure and failure to receive overtime as do hourly rated workers.





dares THIRD WORLD WAR?

They were at Tarawa.

Many of them now wear empty sleeves, or bandages where their eyes were. And a thousand and twenty-six will rise up never from the sands of Tarawa Island.

They couldn't hear it. In the roar of that tornado, as they fought and fell, so far from the hills of home, they couldn't hear the words: . . history repeats . . . and what will we get out of it but . . . how the hell can we police . . . the next one will be against . . . already sowing the seeds for . . . and twenty years from now, brother . . . the Third World War . . . In elevators, on the street, in plush chairs that let you down easy, in columns and editorials and from the political stump.

What is the matter with us? Can't we at home at least go into peace with some spark of their courage and determination that this war is not another mockery, not just another World War? Let no man give voice to that weak and deadly cynicism. Let him stand up and think straight and have the courage to call the lie to any man in public or private life who fails to do the same.

And let each of us do everything humanly possible to help win this war sooner . . . buy War Bonds—give blood—boycott the black market . . . and plan ahead now for a better America than we had before.

Today, the engineers of the machine tool industry can greatly help the post-war planners of government and business management. One of these is a Bryant man . . . We invite you to send for him.



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YANT CHUCKING GRINDER COMPANY SPRINGFIELD, VERMONT, U. S. A.

Obituary

the General Electric Company since 1935, died June 4 at the Clifton

Springs Sanitarium.

J. Thomas Talbot, 48, an executive of the American Brake Shoe Company, died suddenly at his home in Bronxville, N. Y., on June 6. He joined Brake Shoe's Sales Dept. as inspector in June, 1920, and was made sales representative in January, 1922, covering the Southeast. He returned to New York in 1935, and in January, 1937, was appointed assistant vice-president of the Brake Shoe & Castings Division.

On Sept. 1, 1940, he was appointed vice-president in charge of sales for Ira D. LeFevre, 61, comptroller of . both the Brake Shoe & Castings and Southern Wheel Divisions. ary, 1944, he was elected vice-president and director of the Dominion Brake Shoe Company, Ltd.

John W. Robb, 64, vice-president and treasurer of A. C. F. Motors Co., died June 6 at New York following a short

illness.

Herbert Andrew Montagu Lord Douglas-Scott, board chairman of Rolls-Royce, Ltd., died June 18 at Winchester, England. He was president of the Federation of British Industries in 1934-35.



ANTI-FRICTION WORLD

MAKERS of

THRUST BALL BEARINGS.

Standard and Special ANGULAR CONTACT

BALL BEARINGS

BALe RETAINERS

GROUND WASHERS

Of countless brilliant improvements created by war production, none is more deeply worthwhile, none has more of basic usefulness, than the new applications of anti-friction bearings. We of Aetna know these, for we have helped to perfect them

-know their rich potential for creating a truly Anti-Friction World.

In getting ready for that new industry of peace, Aetna is helping many businesses-helping to develop new products and revitalize old

ones-helping with plans to recreate warworn plants and equipment.

Is your business ready for the Anti-Friction World? Aetna engineers can help you, too. It's an idea that deserves action -simply call Aetna, or write.

> AETNA BALL BEARING MANUFACTURING CO., 4600 Schubert Ave., Chicago 39, Ill.

> > IN DETROIT 2:

SAM T. KELLER. 7300 Woodward Ave., Madison 8840-1-2.



Business in Brief

Written by the Guaranty Trust Co. New York, Exclusively for AUTO-MOTIVE AND AVIATION INDUSTRIES

General business activity shows continuing stability. The seasonally adjusted index of *The New York Times* for the week ended June 3 stood at 143.8, as compared with 143.4 for the preceding week and 137.1 a year ago.

Department store sales, as reported by the Federal Reserve Board, rose from 147 to 153 per cent of the 1935-39 average in the week ended June 10: and the indicated value was 2 per cent above the corresponding sum in 1943. For 1944 to date, the total is 6 per cent greater than the comparable amount last year.

Railway freight loadings during the week ended june 10 totaled 874,193 cars, 7.8 per cent more than the preceding weekly number and 2.3 per cent above the corresponding figure in

1943.

Production of electric power increased more than seasonally in the same period; and the total was 5.5 per cent above the output a year ago, as against a similar excess of 5.6 per cent reported a week earlier.

Crude oil production during the week ended June 10 averaged 4,522,-500 barrels daily, 250 barrels below the figure for the preceding week and 63,100 barrels less than the average output recommended by the Petroleum Administration for War.

Estimated production of soft coal during the week ended June 3 was 11,870,000 net tons, as compared with 12,575,000 tons in the preceding week. For 1944 to date, output is 8.6 per cent

above the comparable amount in 1943. Engineering construction contracts awarded during the week ended June 15 totaled \$29,222,000, as against \$12,-923,000 for the week before, according to Engineering News-Record. Contracts so far reported this year show a decline of 52 per cent from the cor-responding amount in 1943.

The Irving Fisher index of whole-sale commodity prices declined by a negligible fraction in the week ended

negligible fraction in the week ended June 9 from the all-time peak, 113.0 per cent of the 1926 average, as against 112.3 a year ago.

Member bank reserves increased \$375,000,000 during the week ended June 14, and excess reserves rose \$300,000,000 to an estimated total of \$1,100,000,000. Business loans of reporting members increased \$24,000,000 in the preceding week and stood \$233. in the preceding week and stood \$233,-000,000 above the total a year earlier, June 16, 1943.

CALENDAR

Conventions and Meetings

SAE Natl. West Coast Transportation & Maintenance Meeting, Portland, August 24-25 Oregon

SAE Natl. Tractor Meeting, Milwau-Sept. 13-15

SAE Natl. Aircraft Eng. & Production Mtg., Los Angeles Oct. 5-7

SAE Natl. Fuels & Lubricants Mtg., Tulsa Nov. 9-10

American Chemical Society Natl. Chemical Exp., Chicago.....Nov. 15-19

SAE Natl. Air Cargo Mtg., Chicago, Dec. 4-6

SAE Annual Meeting, Detroit

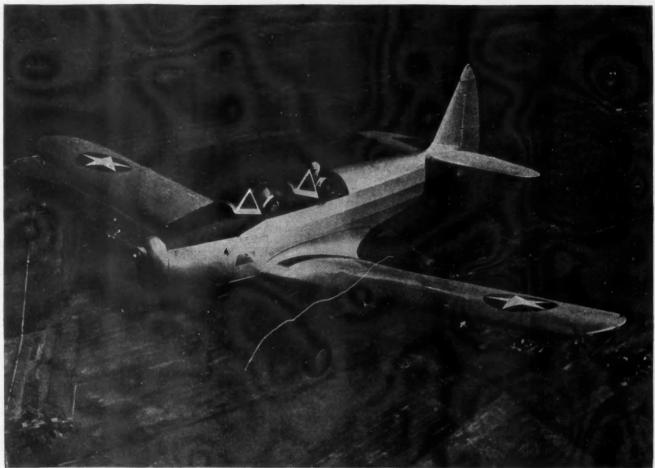


Photo-Courtesy Fairchild Aircraft

RIDING ON AIR DEMANDS THE STRENGTH AND LIGHTNESS OF A Steel Tube FRAME



Steel Tubes...

bave no superior for the airplane framework. The welder makes fast work of assembly and welding on fittings.

Seamless steel tube struts make a fuselage frame for this Fairchild Trainer that combines strength with lightness. Globe Seamless Steel Tubes are made in a plant devoted exclusively to the manufacture of steel tubing . . . where every process from piercing the billet to finish grinding is closely controlled.

Globe Steel Tubes Co.'s customers have at their service our large technical staff and completely equipped laboratory. We will be glad to aid you in selecting steel tubing to meet your particular requirements.

★ Boiler and Pressure
Tubes
★ Condenser and Heat
Exchanger Tubes
★ Stainless Tubes
(Seamless Pure Iron
(Seamless Pure Iron

GLOBE STEEL

GLOBE STEEL TUBES CO. Milwaukee 4, Wisconsin, V. S. A.

Bendix to Build Helicopters

Formation of Bendix Helicopter, Inc., has been announced by Vincent Bendix. An engineering company, Helicopters, Inc., was organized by him in 1943 to take over the development of a new type of helicopter. That corporation has now become Bendix Helicopter, Inc., with Mr. Bendix as president.

Associated with Mr. Bendix is a group of leaders of the industrial world, among them many of his former associates in the various successful en-

terprises he has founded in the past. Bendix Helicopter, Inc., is not affiliated in any way with the Bendix

Aviation Corporation.

The new helicopter is said to contain original and exclusive principles of operation and performance based on inventions by Mr. Bendix.

Three models are currently being engineered in the company's development program. Included is a two-passenger, 165 horsepower helicopter with a top speed of 120 miles per hour; a 10passenger one-ton helicopter of 600 horsepower, and a 20-passenger twoton airbus of 1200 horsepower.

Officers of the newly formed cor-

poration are: Vincent Bendix, president; Claire L. Barnes, vice-president; Martin Jensen, vice-president; James W. Garside, treasurer, and Charles L. MacDonald, secretary.



Names and winners of Army-Navy "E" awards in or allied with the automotive and aviation industries, announced since the June 15 issue of Automotive and Aviation Industries went to press:

ASSOCIATED SPRING CORPORATION, Raymond Mfg. Co., Corry, Pa.

ATLAS POWDER COMPANY, Giant Division, Giant, Cal.

BEHR-MANNING CORPORATION, Norton Pike Company, Littleton, N. H.

CHROMIUM PROCESS COMPANY, Shelton, Conn.

COMMERCIAL SOLVENTS CORPORA-*TION, Dixie Ordnance Wks., Sterling-ton, La.

THE DAVISON CHEMICAL CORPORA-TION, Curtis Bay Plant, Baltimore, Md. GENERAL ELECTRIC COMPANY, Syra-

cuse Works, Syracuse, N. Y.
GOODYEAR TIRE AND RUBBER COM-

PANY, Goodyear Clearwater Mill No. 1, Cedartown, Ga.

GOODYEAR TIRE AND RUBBER OM-PANY, Goodyear Clearwater Mill No. 2, Rockmart, Ga.

KOLD-HOLD MANUFACTURING COM-PANY, Lansing, Mich.

MANSFIELD TIRE & RUBBER COM-PANY, Mansfield, Ohio.

MILWAUKEE STAMPING COMPANY, Milwaukee, Wis.

POWERS REGULATOR COMPANY, Chicago, Ill.

SHELDON MACHINE COMPANY, INC., Chcago, Ill.

STEWART-WARNER CORPORATION, Green River Ordnance Plant, Dixon, Ill. A. B. STOVES, INC., Battle Creek, Mich.

THE STUDEBAKER CORPORATION, Studebaker Pacific Corporation, Los Angeles, Cal.

WARD PRODUCTS CORPORA-THE TION, Cleveland, Ohio.

WESLEY STEEL TREATING COMPANY, Milwaukee Plant, Milwaukee, Wis.

"E" Star Awards

for continued meritorious services on the production front have been awarded to the following firms:

THE BULLARD COMPANY, Bridgeport,

ATERPILLAR TRACTOR COMPANY, East Peoria, Ill. CATERPILLAR

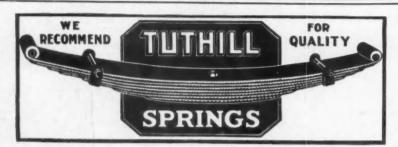
COLUMBIA STEEL AND SHAFTING COMPANY, Carnegie, Pa.

PRATT & WHITNEY, Division Niles-Bement-Pond Company, West Hartford,

SKILSAW, INC., Chicago, Ill.

SUMMERILL TUBING COMPANY, Bridge-

UTAH RADIO PRODUCTS COMPANY, Chicago, Ill.



Why we recommend TUTHILL as a Quality Spring-

JUALITY is its own best argument. It proclaims in service the fact that it embodies the best in design, materials and workmanship. It is the thing most desired by user and manufacturer alike—the binding link in service and good-will. Here's why we claim Quality for TUTHILL:

- 1. Material control. Each shipment of steel from which Tuthill Springs are made is inspected to see that it conforms to S. A. E. standards based on chemical analysis.
- 2. Superior heat treatment, pyrometer controlled, insures right tempering, correct hardness, toughness and resilience. Continuous heating and tempering furnaces, modern in every way, temper and toughen Tuthill Springs.
- 3. Shot blasting. New conveyor type of Shot-Peening equipment is used to give added strength and longer life to Tuthill Springs.
- 4. Experience. Sixty-four years of constant progress in improved methods and heat treatment insures exceptional performance under all load and service conditions.

TUTHILL not only manufactures a complete line of standard leaf-type springs, but also makes to order special types of springs to meet your specifications. Advise your requirements and let our engineers submit specifications, with recommendations.

Submit your Spring problems with details

SPRING COMPANY

763 W. Polk St. CHICAGO 7, ILLINOIS

THE FORBIDDEN ROOM...

There are only six keys to the door, and the lock is often changed. . . . For this is a very private room. It is in the plant of one of America's greatest corporations, and behind the door to this inner sanctum part of the future is being

There are literally hundreds of "forbidden rooms" in America today, where the plans, the designs, the mock-ups and models are being made for countless new products and machines-from giant electrical power plants, still in the experimental stage, to table-model television sets, now a solid post-war certainty.

Few outsiders ever enter this inner circle . . . but one of these is the machine tool engineer.

For equally as important today as any brilliant new design is the cost of manufacture—and it is here that the machine tool engineer comes in. Leading manufacturing executives know that this factor of cost is going to be more important, in the fast competition of the post-war period, than ever before in history.

It is because of this that Jones & Lamson engineers are being taken into their conferences and their confidences: helping them to plan complete production line set-ups for the day this war ends.

Even more important than the machine tools your company uses is the machine tool engineering that goes with the use of those tools!





JONES & LAMSON Manufacturers of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Compara-

SPRINGFIELD, VERMONT, U.S.A. Profit-producing Machine Tools

Manufacturers of: Universal Turret Lathes • Fay Automatic tors · Automatic Opening Threading Dies and Chasers.

We'd Still Put Our Money On



EVEN though the hare lost its famous race with the tortoise, we think we'd back the long-eared animal in any rematch. And production speed is going to be a vital factor in the postwar world. Indeed, our hope of postwar prosperity is based largely on low-cost production . . . to keep consumption high and provide jobs for everyone.

Here at Acme our consulting engineers can help with your production problems-current or postwar. We also design and build special tools; produce dies, patterns, gages, fixtures. And no better heat-treated aluminum castings are made than those which carry the Acme name,

Your inquiry will receive prompt attention.



Pallern and Tool Company, Suc.

T-TREATED ALUMINUM CASTINGS ... PATTERNS ... TOOLS TOOL DESIGNING ... PRODUCTION PROCESSING

PERSONALS

manager of the Chevrolet-Flint Division of General Motors, succeeding the late F. A. McHale

Donald U. Bathrick has returned to his old post as general sales manager of Pontiac Motor Division of GM after two years in the Washington office of GM, most re-cently as manager of that office.

B. C. Anderson, formerly Pittsburgh zone manager for the Nash-Kelvinator Sales manager for the Nash-Kelvinator Sales Corp., has been appointed assistant gen-eral sales manager of the Nash Motors Division. He succeeds **Godfrey Strelinger**, who recently was elected treasurer of the corporation.

William G. Hancock, general sales man-

ager of McCord Radiator & Mfg. Co., has been elected a director of the Automotive Council for War Production, taking the place of the late H. W. Knapp, secretary

of McQuay-Norris Mfg. Co.
Frank G. Horton, executive secretary of
the Illuminating Engineering Society, New
York, since 1924, has been named managing secretary of the Engineering Society
of Detroit, succeeding the late E. L.
Reandt Brandt.

Henry Ford, president of Ford Motor Co., has been awarded the Migel Medal by the American Foundation for the Blind for "outstanding service to the blind" in pioneering industrial processes that can be performed well by blind persons.

A. N. Guy has been appointed manager of the automobile tire department of the Fisk Division, U. S. Rubber Co. He was manager of the batteries and accessories dept. of U. S. Rubber Co. until the war, when he handled tank track sales with the

when he handles Ordnance Dept. Frank J. Kennedy, formerly assistant Frank J. Kennedy, formerly assistant correlary, has been elected secretary of secretary, has been elected secretary of Electric Auto-Lite Co., succeeding R. H. Landwehr.

He

Howard C. Steiner, formerly assistant Howard C. Steiner, formerly assistant managing director, has been named managing director of the Goodyear Tyre & Rubber Co., Ltd., of Australia, succeeding W. G. Kither, who has resigned because of poor health.

G. S. Staunton, formerly sales manager of the Ternstedt Mfg. Division of General Motors Corp., has been appointed assistant automotive sales director of the Bendix Products div. of Bendix Aviation Corp.

Products div. of Bendix Aviation Corp.

Wilkening Mfg. Co. has announced the appointment of Sam S. Evans to the post of manager of the company's replacement sales division.

The appointment of C. P. Croco as manager of a newly formed welding dept. of the division at the Trafford, Penna., works. has been announced by the Westinghouse Electric & Mfg. Co.

Paul E. Frantz has been appointed operations manager of Adel Precision Products

John M. Noble has been appointed district manager in charge of the newly established Santa Monica office of Walter Kidde & Co. He was formerly manager of the aviation department at Kidde.

Eugene Holman, a vice-president of the Standard Oil Co. of N. J., was elected president to succeed Ralph W. Gallagher, who was made chairman of the board. Mr. Gallagher will remain as chairman of the executive committee.

executive committee.
Frank K. Metzger, formerly divisional vice-president of Standard Steel Works Div., has been elected vice-president in charge of sales of The Baldwin Locomotive Works. John D. Tyson, of the Standard Steel Works staff, has been elected vice-president in charge of that division.
The appointment of Frederic S. Giover as deputy director of the Automotive Div. of the Equipment Bureau, WPB, has been announced. Mr. Giover is a former executive of Reo Motor Car Co. and Timken Detroit Axle Co.

Detroit Axle Co.

Detrex Corp. has made the following personnel announcements. Thomas J. Kear(Turn to page 64, please)



Heat-treater placing an embossing die in a Vapocarb-Hump Hardening Furnace

MUST TOOLS PRODUCE MORE?

Vapocarb-Hump Hardening Helps in 3 Ways

During this year's Battle of Production, hundreds of metal-working plants are finding that the Vapocarb-Hump Method of Hardening helps to bring about big increases in the life of punches, dies, hobs and other war-production tools.

If you have a war-goods tooling problem, we'll gladly arrange for you to talk to people in some of these plants. The 'll tell you of three ways in which tool life is prolonged: (1) By lessening or ending warp. (2) By better depth of hardness. (3) By ending all surface blemishes.

But, because all three seldom are found in one tool, we're showing here an example of each. You'll understand why these cases must be taken from pre-war production!

Warp Defeated In Perforation Die

A Maryland company used to make 2 or 3 big diamond-pattern perforating dies at a time, because heat-treating warp twisted them "like pretzels," and grinding them straight weakened them and shortened their Vapocarb-Hump Hardening, by its uniform heating, ended warp and doubled the lives of these tools.

One Die Does Work of 30

Belt buckle dies were producing an average of 1200 pieces, because the heat-treater could only guess when to quench them, in hardening, and their structure was accordingly weak. Vapocarb-Hump Hardening, by locating and recording the critical point, helped increase the production, successively to 2300 pieces, then 8500, then 18,000 and finally 38,000 - an average of 30 times the pre-Vapocarb figure.

Perfect Surface For Stamping Die

Life of engraved dies, like the one shown, was often shortened because the method of hardening which was employed permitted surface pits or scale to form. These had to be "polished" out, thus weakening the hardened skin. Vapocarb-Hump hardening eliminated this because its protective atmosphere ends all scaling and pitting in furnace; average life of dies has been sharply increased.

Further particulars of Vapocarb-Hump Hardening are given in Catalog T-621, or an engineer will call on request to discuss a specific problem.



Warp Ended Means No Grinding

Correct Structure Increases Production



Perfect Surface Saves Hours of Polishing

Jrl. Ad T-621(27)





LEEDS & NORTHRUP COMPANY, 4966 STENTON AVE., PHILA., PA.

MEASURING INSTRUMENTS TELEMETERS . AUTOMATIC CONTROLS . HEAT-TREATING FU .NACES



MACHINE COMPANY

RZEPPA

The Region of State of

Constant Velocity

UNIVERSAL JOINT

THE constant angular velocity of the Rzeppa Universal Joint has made possible the extended use of front wheel and multiple drive vehicles by our armed forces. This joint transmits power, without periodic vibration, over an unusually high deflection range.

flection range.

It is simple in construction, made of the highest quality alloy steels and built with precision ground parts. Its dependability and freedom from service troubles make it ideal for automotive applications — propeller shafts, steering axles, live front and rear axles with independently sprung wheels, as well as marine and aviation applications, tractors, locomotives, machine tools, shuttle cars and many others.



Personals

(Continued from page 60)

ney, formerly technical advisor to the director of sales, has been promoted to assistant chief engineer in charge of in-dustrial equipment design and detailing.

dustrial equipment design and detailing. John A. Faler, assistant chief engineer, has been appointed to take charge of extraction equipment development.

The appointment of H. C. Gates as factory manager, Aeroquip Corp., has been announced. Also announced were the following appointments. R. J. Wilson, formerly with General Motors and Fruehauf, machine shop superintendent; Alex McLain, formerly of Balsch-Lundberg Mfg. Co., assembly department superintendent; Ed Hurley, with J. I. Case Co., as manager of production control and, Donald C.

Draper, as production and tool engineer.

The appointment of Theodore Lyman as general manager of the government-owned synthetic rubber plant, operated by The General Tire and Rubber Co. at Baytown, Texas, has been announced.

PUBLICATIONS

1944 edition of the Hydraulic & Pneumatic Leather Packings, published by E. F. Houghton & Co., is now available at \$1.00 a copy. The major por-tion of the book is devoted to design and service problems and pertinent informa-tion concerning them. There is also an tion concerning them. abundance of specifications and reference

data. Copies are obtainable from E. F. Houghton & Co., Philadelphia 33, Pa.
Continental-Diamond Fibre Co. has issued bulletin FP-43 on Design and Fabrication of Laminated and Molded Phenolic Plastics and vulcanized fibre parts.*

Reading-Pratt & Cady Div., American Chain and Cable Co. has released a new illustrated chart, How to Protect Your Valves. The chart is 11 x 17 inches and contains simple, factual copy illustrated by graphic sketches portraying the right and

graphic sketches portraying the right and wrong way to handle each situation.*

The New Jersey Zinc Co. has issued a new booklet, The ABC of Luminescence, which discusses in simple language the characteristics, properties, limitations and applications of the inorganic luminescent pigments, as well as the terms applicable to this industry. Tables and charts are included to illustrate various terminology.*

A new brochure issued by Chrysler Corp.

new brochure issued by Chrysler Corp., entitled Peacetime Enterprise Put to Work touches on a sampling of wartime production activity ranging from tiny gears to 30-ton tanks. It is pictorial in pres-entation and covers a variety of products such as aircraft engines and airframes,

landing gear, tanks, tank engines, trucks, ammunition, etc.*

York Corp. has issued a new catalog of accessories and supplies for refrigeration and air conditioning plants. It is the loose leaf type, divided into sections and tabbed for ready reference.*

Publication of a new Aircraft Catalog nd Handbook is announced by The Weatherhead Co. Included are compre-hensive sections on AN Fittings, AAF 811

hensive sections on AN Fittings, AAF 811 Fittings, Aircraft Hose and Hose Assemblies, valves and hydraulic cylinders and a compilation of useful engineering data.* Forss Pneumatic Tool Co has issued two new folders, one describing its Size HA-39, Model 1000 and Model 1001 Slow Hitting Aircraft Riveting Hammers and the second describing and illustrating its Size second describing and illustrating its Size HA-19, Model 1002 and Model 1003 Slow Hitting Aircraft Riveting Hammers. Both folders contain specifications of the models and maintenance instructions.*

A new condensed catalog covering all South Bend Lathes has been issued by South Bend Lathe Works. It illustrates and describes engine lathes, toolroom South Bend Lathe Works. It illustrates and describes engine lathes, toolroom lathes and precision turret lathes for practically all types of production, toolroom and maintenance work.*

The Middle of the Shop is the title of a

new, pocket size booklet written by Tom Saffady of Sav-Way Industries. It is addressed to production men "who still like to get their hands dirty." Copies may be had by writing Sav-Way Industries, 4875

East Eight Mile Road, Detroit, Mich.
The DeVilbiss Co. is offering a conditioning table to help users of spray-painttioning table to help users of spray-painting equipment make their present units last longer. Illustrations accompanied by simple directions show operators the most important steps to follow in caring for spray guns, paints cups, hose, etc.*

A new 16-page, illustrated catalog describing the improvements and uses to which the new Simlok fastener can be put, has been issued by the Simlok Div of the

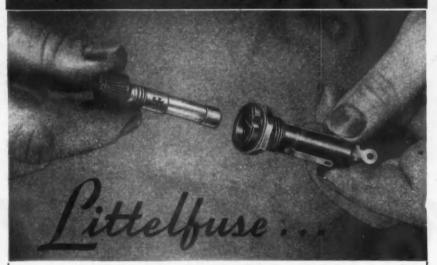
which the new Simlok fastener can be put, has been issued by the Simlok Div. of the Simmons Machine Tool Corp.*

The Nitralloy Corp. has published a new booklet entitled Wear, A Discussion of the Mechanism of Wear Phenomena and influencing Factors. The booklet is by Mr. D. Landau and contains a variety of important and interesting facts concerning wear, tables and charts, and a bibliography.

BullDog Electric Products Co. has published catalog #441 giving basic information, list prices, dimensions, etc., on safety switches, light and power panelboards, switchboards. Bulletin #427-1 illustrating and describing BullDog Bustribution Duct of the ventilated low reactance type for feeder circuits up to 2000 amperes, has also been announced.*

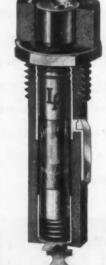
Obtainable by subscribers within the United States through Editorial Dept. AUTOMOTIVE and AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

A STRONGER FACTOR in TODAY'S NEW COMPLETE CIRCUIT PROTECTION



EXTRACTOR POSTS WITH WELDED ANTI-VIBRATION SIDE TERMINALS

NOW UNDERWRITERS' APPROVED



Extractor Post No 341001, for 3 A G Fuses. Tool-operated. Welded side terminals. Knob and body black bakelite. Positive fuse grip. Full visual shock-proof inspection. Spring-activated cup. Specially designed grip prevents fuse from dropping out.



No. 342001 Operated Type Resistance to extremes of shock, vibration and temperatures is provided by Littelfuse Extractor Posts with electrically welded side terminals. By Littelfuse process, terminals are made integral with inside metal shell. Maximum conductivity is insured. Other Littelfuse improvements for dependability, durability, and convenience make these outstanding examples of Littelfuse complete circuit protection.

Send for B/P and ENGINEERING DATA **Ask for Samples**

Littelfuse will be glad to counsel with you on safeguarding new equipment, or irreplaceable present equipment. Fuses, Fuse Clips, Fuse Panels, Circuit Breakers, Thermocouples, Fine Wire Products. Indicators, etc.

LITTELFUSE INCORPORATED

4757 Ravenswood Ave., Chicago 40, III. 200 Ong St., El Monte, Calif.



NO. 7 OF A SERIES "HIGHLIGHTS OF WORLD WAR II" PRESENTED BY TUBE TURNS (INC.) LOUISVILLE, KY. SEE CITER S

Close-Duarter, Action or JAMES M. SESSIONS

ET / TETION BY JAMES M. SESSIONS



LIGHT metals are forging's problem children . . . especially for products whose end use is as critical as aircraft engine pistons made of aluminum. Heat treats must be precise to the nth degree, in number and control.

Tube Turns solved the perplexing dual problem of volume production and absolute quality control by utilizing their huge upset forge equipment and modern heat treating furnaces—then developing a streamlined production technique which today serves as a pattern for the industry. Proof that light-metal forgings can be produced on a mammoth scale, as evidenced by Tube Turns' success, may well revolutionize postwar thinking in many industries.

TUBE TURNS (Inc.)

"Close-Quarter Action." With thrilling realism, artist Sessions presents his conception of an engagement between an American destroyer and a Japanese light cruiser. Destroyer is shown in the left foreground. tim

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TUBE TURNS Forgings for Industry

New Products

(Continued from page 50)

Wires insulated with Natvar 400 may be soldered without special care or technique and without flow or opening of the tubing near the point of soldering. It is tough, resistant to tear, has tensile strength in excess of 3000 psi, with elongation from 170 to 410 per cent depending on type of tubing, and remains flexible down to —80 F. Its electrical characteristics are the same as those of conventional vinyl tubing.

Natvar 400 is chemically inert, and is suitable for oil lines, sheathing and other protective coverings in applications where adverse oil, solvent or acid condition are severe, and where protectection from chemicals or vibration is required over a wide temperature range.

Torque Wrench with Positive Break-Away

A torque wrench which can't overtighten in operation and which combines right and left-hand torque in one wrench, is offered by Aircraft Tools, Inc., Los Angeles, Cal.

The wrench is full ratchet so that



Torque wrench made by Aircraft Tools, Inc.

when desired tension is reached, positive break-away occurs one notch at a time. Adjustments ranging from 10 to 60 lb. can be made by the use of a special wrench furnished with the tool.

All torque load is carried on precision ball bearings and heat-treated tool steel parts, packed in grease. Spring fatigue is cut to the minimum as torque spring is in repose except when in use. All parts of the wrench are interchangeable.

Torque setting is indicated on the head bolt, with various torque settings available on request. The tool is furnished with adjusting wrench, % insquare drive, screw driver tip and hose clamp socket.

Steel Stamps with Rounded Face Characters

Rounded face characters, of special design, are being introduced by Jas. H. Matthews & Co., Pittsburgh, Pa., for engraving on steel stamps, steel dies, and type for marking where the use of sharp face stamping tools might be

injurious to the parts being marked.

The new rounded face and special character designs provides a minimum of set-up stress, and can be supplied in single letter and figure stamps, stamping dies for use in foot or power operated presses, and roller dies for use in all types of marking machines and in steel type for use in steel type holders. Also, in multiple character stamps for marking flat, concave or convex surfaces.



Matthews steel stamp of special design

Whenever You Are Ready to Talk About the Thermostats on Your Next New Models...

Write-Wire-Phone Us.

THE DOLE VALVE COMPANY

1901-1941 Carroll Ave., Chicago 12, Illinois

Los Angeles

Detroit

Philadelphia



It's the production ingenuity of Western Automatic engineers that assures you flawless small parts in large volume

Small parts made with unerring precision are vital these days when the lives of our fighting men depend on them—but just as important is the need to produce them fast, in huge war quantity. Western's engineering ingenuity shines at that...for instance, on this airplane carbureter idle-valve bushing, machined from solid brass. It moved through with speedy exactness in spite of multiple finishing operations, because of special fixtures which carried it through milling and punching operations and assured accuracy of

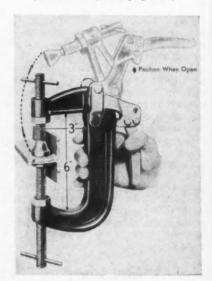
position of slots and half-round holes. You'll need this kind of fast accuracy post-war — write for the story of Western's skill and vast modern capacity now.

Send for this valuable new catalog of Western Socket Screws—complete data, 32 pages.



New Production Equipment

(Continued from page 46)



De-Sta-Co Model No. 480 "C" clamp

bolts the toggle handle may be adjusted to either straight out or downward position when clamp is locked. This improved clamp is a 6 in. size, with 3 in. throat, and is listed as De-Sta-Co Model No. 480.

LATEST addition to the line of metallizing guns of the Metallizing Engineering Co., Inc., Long Island City, N. Y., is the Metco Type 3E gun which is especially engineered for the high speed production spraying of low melting point metals. It handles 1/6-in, zinc, tin, lead, solder, babbitt, and cadmium, or fine-gage copper and copper alloys.

Regardless of the type of wire employed, no gear changes are necessary to achieve high speeds. Any spraying speed within the prescribed ranges is automatically obtained and maintained by the controlled power unit, an integral part of the gun. Air

(Turn to page 72, please)



Metco type 3E metallizing gun



fits your grip perfectly. Its fine balance and business-like detail give a sense of confidence. Agreeable temperature comforts your hand.

These are qualities important to future automotive steering wheels, handles and knobs-improved grip, better looks, more comfort-all asmanence, moisture resistance.

Unlimited choice of color and the big range of Lumarith formulations for molding over metal (and assuring compatible expansion and contraction coefficients) provide materials precisely suited to individual

*Reg. U. S. Pat. Off.

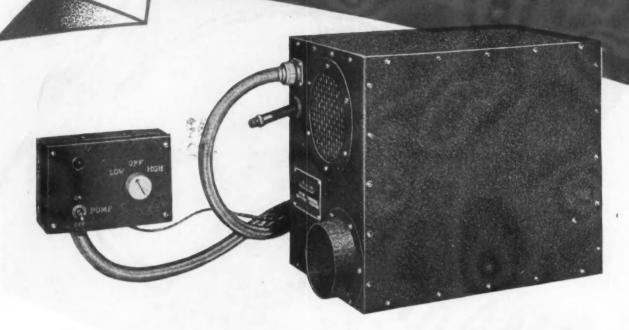
P.S. Our Technical Staff talks your language. Celanese Celluloid Corporation, The First Name in Plastics, a division of Celanese Corporation of America, 180 Madison Avenue, New York City 16.

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NEW Combustion Process



Fluid Heat's New Model SAH-20 "Under the Hood" Truck Heater



This heater has a maximum output of 20,000 BTU per hour, yet weighs only 21 pounds, fits easily under the hood of any truck. Overall dimensions are $7^1/4$ inches wide, $10^1/2$ inches high, 12 inches long. To insure clearance, heater can be placed in almost any position. Pump enclosed in the unit draws fuel direct from the truck's fuel tank. All models operate on 6, 12 or 24 volts D. C. or 110 volts A. C. Model SAH-40, not shown on these pages because it is identical in design, delivers 40,000 BTU per hour. It is 13 inches by $10^1/2$ inches by 19 inches, weighs only 40 pounds.

(at left

Fluid Heat's Model SAH-15T

Designed for trailer and cargo-space heating, this model has an output of 15,000 BTU per hour and has a convenient hand-replenished fuel tank compactly built onto the top. Built-on tank makes the heater a completely independent, self-contained unit, permitting uncoupling of trailer without fussing with fuel lines.

Utilized in FLUID HEAT'S ADVANCED MODELS of Truck Heaters

EMPLOYING the principles used in its aircraft heaters, Fluid Heat's new "under the hood" truck heaters are compact and light, yet economical and powerful, controlled conveniently from the dash. Models for trailer and cargo-space heating are available, as well as adaptations for passenger cars. For dimensions and operating details, see illustrations opposite. These heaters are a new development in automotive heating.

New Combustion Process

Fluid Heat Truck Heaters employ a vapor entraining process utilizing pre-heated combustion air. This process accomplishes combustion with an unusually low pressure drop, permitting operation at low combustion air pressures and thus reducing the power load to the amount of electricity required for an ordinary light bulb. The process produces a completely suspended fire and therefore gives freedom from lead oxide forma-

tion. Flame retention is so positive that flame characteristics are the same under all atmospheric conditions.

Development Background

Fluid Heat has, for sixteen years, pioneered in the development and manufacture of automatic combustion and heat transfer equipment. Those years of heat engineering know-how are built into each light, compact, economical Fluid Heat Truck Heater. You'll want Fluid Heat Truck Heaters on the trucks, trailers or cars you design, build or equip. Write for full information on this new heating achievement.

FLUID HEAT DIVISION

Anchor Post Fence Co.

6760 Eastern Ave., Baltimore 24, Md.



pressure fluctuations do not affect its operating efficiency.

The Type 3E is equipped with a universal gas head, which allows the tool to be operated on any commercial gas—in conjunction with oxygen and compressed air. A duplex mounting fixture is provided for permanent installation on the production set-up.

PARAGON RESEARCH, Inc., Buffalo. N. Y., have designed a new model Farnham forming roll capable of forming leading edge skins or fuselage skins to desired contour, automatically, in



Farnham forming roll

· Weight reduction. • !solating vibration. · Excluding dirt, grit • Temperature maintenance. Retaining lubricants. and dust. · Feeding or wicking oil. Cushioning shock. • Electrical insulation. · Filtering. Many others Thermacoustic insulation. Widely employed as gaskets, channels, washers, padding, insulation, mountings, wicks, and seals, new uses for versatile felt are being discovered daily. Western produces felt to take full advantage of its special properties: resiliency, flexibility, compressibility, resistance to heat, age, alcohol, etc. Western's engineers are able to help you on any problem involving the possible use of felt. Feel free to call on them today.

WESTERN FELT WORKS • 4035-4117 Ogden Ave., Chicago 23, III.

Branches in All Principal Cities



one pass through the machine. Flat aluminum alloy sheets are fed into one side of the machine, and the finished curved parts come out of the other side.

The movement of the upper roll is controlled by two templates, one on each end of the machine. As the part feeds through the rolls these templates raise or lower each end of the upper roll as required, to form the proper contour. Hydraulic pressure is used to keep template followers against the templates, and also to quickly raise the upper roll for inserting the sheet to be formed. Adjustable stops are provided for locating sheets in their proper position in the rolls. The model shown will form aluminum alloy sheets 1/16 in thick, 15 ft. long, to a minimum of 1½ in. radius.

These machines are manufactured by Farnham Manufacturing Company, Buffalo, N. Y.

A LINE of general purpose "Junior" hydraulic presses, in both bench and base types rated 1, 2, and 4 tons, (Turn to page 75, please)



The

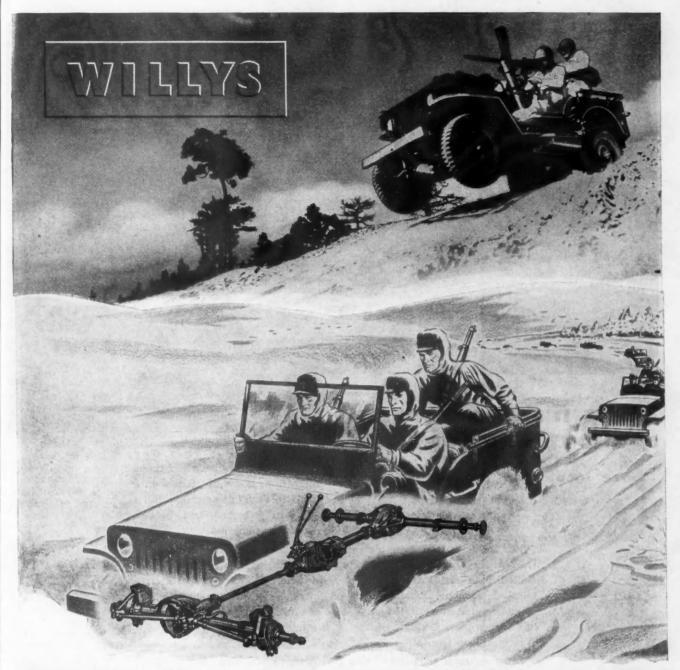
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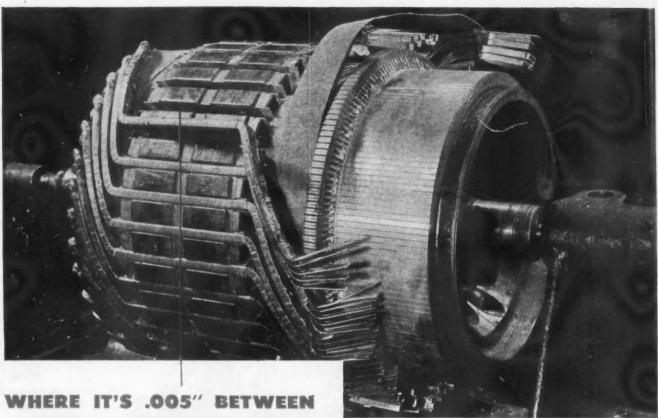
Colonial hydraulic press



"The Sun Never Sets on the Mighty Jeep!"

The one vehicle which the Axis has openly and enviously praised . . . the one vehicle upon whose "head" the Axis has paid a bounty . . . this is the American Jeep. It had its baptism of fire at Guadalcanal. It showed the way at New Guinea. It paced the attack at Casablanca, and was first to track the sands of Sicily. The power arteries of the mighty Jeep . . . transfer case, propeller shafts, front and rear axles . . . all were designed, perfected and manufactured by Spicer. Spicer facilities have met the great production tasks demanded for tremendous Jeep output . . . and this is giving us new experience to meet the automotive demands of tomorrow. Spicer Manufacturing Corporation, Toledo, Ohio.





BURNOUT AND LONG LIFE

...use insulation proved by fifty years of field tests!

There can be only one "right" insulation where space limitations allow insulation only .005" thick. That's the one that's adequately tested and proved for the application.

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For the right insulating material for any and every job-investigate the Westinghouse line of "Tuffernell" Insulating Materials. They're the culmination of fifty years of field tests with every type of electrical equipment. Westinghouse insulation experience with all conceivable types of insulating materials has built up an authoritative file of exact application data. All of it is made available to you through Westinghouse Insulation Specialists.

Some valuable portions of this "insulation know-how" are included in the new Insulation Sample Book which simplifies selection of Micas, tapes, fabrics and papers with actual samples. It helps identify different grades, gives dimensions, ratings, and helpful application data. Copies are available through your nearest Westinghouse distributor. Ask for B-3322. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N. J-06356





is being introduced by Colonial Broach Company, Detroit, Mich. The presses may be converted from bench to pedestal types or vice versa.

Two-unit construction is used in the pedestal types. The upper unit is the bench type press which is rigidly bolted to a reinforced base to form the pedes-

tal type.

Platens are counterbored concentric with the ram, permitting ready installation and locating of fixtures in line with the ram movement on the machine. The base below the platen is slotted and relieved to permit ready use of the press for assembly work. The sides of the slot are machined in relation to the axis of the ram, to equalize clearance for fixtures on both sides.

Low-Temperature **Curing Adhesive**

A new synthetic resin, a low-temperature-curing adhesive of the phenolformaldehyde type for bonding a wide variety of heavy lumber and timber constructions, is made by the Resinous Products & Chemical Company, Philadelphia, Pa. Known as Amberlite PR-75-B, this resin is useful in the manufacture of oak ship keels and laminated structural members for columns, timbers, arches and trusses and is said to be proving especially adapted to aircraft work.

Amberlite is supplied as a viscous reddish-brown solution, which is infinitely dilutable with alcohol, and can also be diluted with water to any practical spreading consistency needed. Amberlite PR-75-B has a storage life of a year at room temperature. It is used with Catalyst P-79 which is added at the time of use to effect proper cure. The cured glue line exhibits a pH in the range 6-7 and meets the strength and durability requirements of Army-Navy Specification AN-NN-P-511b (plywood, aircraft, flat panel) as well as the strength, durability and acidity requirements of Bureau of Ships Specification 52-G-12 (Interim) (glue, phenol-formaldehyde, low temperature setting) and the new Army Air Force Specification 14124 (glue; low temperature setting).

Quick-Acting Magnetic Brake

A magnetic brake, which will stop a 1/8-hp motor traveling at 16,000 rpm in less than six revolutions, has been developed by the General Electric Company, Schenectady, N. Y. Although the new brake is not yet commercially available, it is expected to have wide use in the operation of equipment for the armed forces. Its specific applications, however, were not revealed by the company.

It is called a magnetic brake but magnetism plays no part in its stopping operation. A cork shoe and friction do the work. Magnetism releases it, once the need for braking is removed. The motor is braked at all times, except

when current is applied.



Speed Constructing Advance Military Bases

(Continued from page 24)

to withstand temperatures brackets from —40 F. to 130 F. constant relative humidities as high as 85 to 90 per cent; extended periods of storage in the rain, in ocean fog and even in and other unforseen situations.

By means of experimentation and experience, it has been determined that non-precision parts can be amply protected by cleaning, applying preservatives, wrapping in a special paper and boxing in a strong container. For precision parts, the protective process includes: Cleaning, preserative, wrapping in a neutralized paper and in a water-proofed paper, wax-sealing and boxing in a strong, waxsealed container. Complete units such as engines and

vehicles are further protected by enclosing dehydrating chemicals within the package before sealing to absorb moisture within the space.

Ordnance Materiel As Received in Pacific Theaters

By H. T. Holbrook, Assistant Chief, Ordnance Packaging Section

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THERE are no docks at advance bases in the Pacific and so equipment comes in for some rough handling in being landed. The standard method of unloading a cargo vessel is to pile boxes, crates and pallets into sling nets, hoist them out of the hold, and lower them-net and all-into a "duck" boat bobbing around in the sea. The duck then transports the load to the shore, up the beach, and often, over several miles of muddy, bumpy road to a supply dump. The net is then picked up by a crane, lifted to the top of a convenient pile and the net removed letting the load fall where it may. Many other handlings take place, sometimes over a 15-month period, before actual use of the equipment. It is evident that the combination of rough handling and long-time weathering outof-doors point to eventual uselessness of equipment. This was the case until package processing methods were standardized to preclude the possibility of any damage even under the severest conditions.

It has been found that parts and assemblies properly cleaned, preserved, wrapped, sealed and boxed at the factory source reach our fighting men in a good, workable condition, even after months of "being knocked around" and severe weathering.

General Motors Diesel Unit Injector

By C. W. Truxell, Jr., Chief Engineer, Diesel Equipment Div., General Motors

On GENERAL Motors Diesel engines fuel is pumped at 80 psi maximum pressure from the supply tank through a series of filters to a supply manifold, and finally to the individual injectors. Excess fuel from the injectors flows back through the return manifold, the return line and to the supply tank. A restriction is provided in the return line to maintain the desired supply pressure in the injectors.

The essential parts of the injector are the fuel supply circuit, follower assembly, plunger and bushing, rack and gear, and the delivery valve assembly. Continuous flow of oil through the injector eliminates vapor lock and maintains a uniform operating temperature. The fuel enters and leaves the injector through fine sintered-bronze filter elements. An auxiliary flat valve is used in conjunction with a spring-loaded check valve to prevent cylinder pressure from blowing back through the injector if the check valve is held open by a speck of dirt.

The spray tip, which projects into the cylinder, has six or seven openings,



How to Deliver

THE ANSWER TO 4 PROBLEMS WITH ONE FAN UNIT

This aircraft heating requirement was (1) delivery of 13 lbs. per minute (175 C.F.M.) against 8" S.P. at sea level; (2) maintain at least 4.3" S.P. at 23,000° Alt., without mannal or automatic auxiliary controls; be responsible for supplying both (3) combustion air and (4) ventilating air through a 50,000 B.T.U. per hour gasoline combustion heater and airplane heating system. Units to be of high efficiency and extremely low in weight and bulk, designed for direct mounting to the heater.

We have met these specifications with the 2-stage high pressure Axial Flow Fan pictured below. The unit can maintain a 10" pressure head without damage to the motor. Fan is non-overloading. Back-pressure through apertures in the motor housing cools the motor, with cooling proportional to pressure.

This is one example of the special Dynamic Air engineering service available for any problem of aviation, marine or industrial air movement. Call on us. Your special problem is our special business.

DYNAMIC AIR-ENGINEERING

AVIATION and MARINE No. 4582-B-5A

BLADE DIA. 4.58" SHELL DIA. 4-3/4" MOTOR 11,000 R.P.M. LENGTH 12-9/16" WEIGHT 5-3/4 LBS. 0.006 in. in diameter and at an angle of 12½ degrees with the horizontal, evenly spaced about its circumference. Injection pressure at 2100 rpm runs about 40,000 psi. Such a high working pressure imposes many difficulties from the standpoint of making component parts in such a way that they will seal properly and yet not present a commercial barrier, from the standpoint of cost.

The high-pressure seals are of two types, flat and cylindrical. The flat seals go through a series of progressive finishes with the final operation consisting of handlapping each part individually optically flat within one wave length of sodium light and to a 1½ micro-inch surface maximum with a pumice-charged lapping plate.

The cylindrical seal is formed by the plunger and its bushing which must fit so closely that even contact with "clean," human fingers will make it impossible to mate the plunger with the bushings; yet, loosely enough so that the bushing can be spun on the plunger. A seal is considered satisfactory when fuel leakage between the plunger and the bushing does not exceed an amount to dilute the crankcase oil a maximum of 3 per cent in 500 hours of operation. The two parts go through an involved series of finishes

until the bushing has a surface finish within one micro-inch and the fit of plunger to bushing is such as to give an operating clearance of 30 to 60 millionths of an inch—a working tolerance of only 30 millionths of an inch, maximum. Each plunger is a non-interchangeable, matched fit with its bushing, but is not lapped into the bushing.

Experiments in Dust Room Testing

By R. P. French, Studebaker Corp.

N WAR transport long lines of vehicles travel at fast speeds over extremely dusty and rough roads. Under such conditions, dust does affect the vehicle following in the convoy. Rapid wear and damage of vehicle parts result. To investigate and to develop combative measures, both field tests and a laboratory set-up were initiated. Changeable climatic conditions presented some difficulty in the otherwise successful field tests. Subsequently, a laboratory test chamber was created where tests could be conducted under controlled conditions of temperature, humidity, amount and speed of dust, and any other variable factors could be observed and recorded.

After a typical test, all the vehicle parts were dismantled and examined for wear and damage. Many parts were found to be inoperative after little more than the equivalent of a thousand miles of dusty road travel. Cylinder bore; and piston rings, for example, were worn an amount equivalent to 20,000 miles of normal road operation.

Spark-Ignition Fuel Injection Engines for Ground Vehicles

By N. N. Tilley, Chief Engineer, Special Engine Project, Studebaker Corp.

Some of the advantages claimed for fuel injection versus most carburetor manifold systems are: Equality of fuel distribution to each cylinder without pre-heated air; better atomization of the fuel; ability to use a wider range of fuel volatility; elimination of backfiring; possibility of 2-stroke fuel economy approaching that of 4-stroke engines; greater maximum power, better fuel economy and smoother operation; the possible use of lower octane fuels or increased compression ratios or supercharged operation; starting and quicker warm-up; better acceleration and more flexible operation; elimination of exhaust odors during idling plus the resultant savings

On the debit side: Injection systems cost more than carburetor equipment, generally. The reliability in service may not be as good and maintenance costs may be higher. More extensive filtration of the fuel is required to avoid scoring of the closely-fit injectors and pumping equipment. Vapor lock cannot be as easily controlled as in the carburetor type of system. Fuel dilution and its effect on cylinder

(Turn to page 82, please)



WE ARE proud that the Boeing Aircraft Company uses NIBCO WROT Aluminum Fittings in the famous Flying Fortresses that have changed the whole strategy of air warfare. NIBCO products are being used in ever increasing volume by more and more aircraft manufacturers because their uniform accuracy simplifies assembly and speeds up production. They're meeting the most rigid standards and the stiffest inspection. Remember NIBCO in your Post-war planning. We'll be glad to discuss your requirements any time.

WROT Zittings



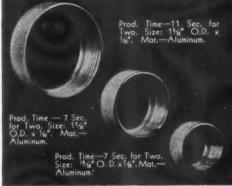
NORTHERN INDIANA BRASS CO.

ELKHART, INDIANA

VES AND FITTINGS SINCE 1904







These three aluminum couplings, vital in aircraft use, are produced on a 1½" capacity Greenlee Six. The machine is tooled with a dual set-up...two parts are produced simultaneously.

The following tooling set-up, used by Chicago Metal Hose Corp. to produce couplings, illustrates the easy application tools on a Greenlee Six.

SEQUENCE OF OPERATIONS

1st Position

4th Position Tap drill 2nd piece.

Form two pieces. Drill small hole for

5th Position Tap 2nd piece.

Knurl two pieces. 3rd Position

6th Position

Cut off 2nd place.

Machine equipped with lead screw for precision threading and tapping. Large part run at 900 R P M; small parts 1100-1300 R P M.

NOTE: Pree reprints of this ad are available to companies wishing them for labor recruitment, etc.

ON A GREENLEE 6-SPINDLE AUTOMATIC

* For thirteen years, Barney Barenbrugge, professional, plied his woods and irons over the fairways to master the game called golf. But, today, like other Americans, he's busy with another profession - helping Uncle Sam win a war!

Fifteen months ago, he was assigned to the job of running Greenlee 6-Spindle Automatics in the plant of Chicago Metal Hose Corporation. He'd had no previous machine experience. Before Pearl Harbor he had never worked in a shop.

But, with thoroughness, he applied himself to this new study of angles, timing and rhythm. He learned rapidly - found his new job interesting. Step by step he studied the fundamentals. Soon, he was able to make tooling changes and precision adjustments, quickly and easily. Today, he operates a Greenlee with the proficiency of a production professional.

Today, with a trade as well as a profession, he aids his Company and his Country to "back the attack." He is producing, on the Greenlee, thousands of precision parts that are machined right to reach the fight. Three of these parts, each produced two at a time on a dual set-up, are shown above.

For detailed facts on features of Greenlee 6, write



GREENLEE BROS. & CO. 1763 MASON AVE., ROCKFORD, ILLINOIS



MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES .

AUTOMATIC SCREW MACHINES . AUTOMATIC TRANSFER PROCESSING MACHINES.

ANNOUNCING

Du Pont Plastics Research Reports Progress in Improving Transparent Plastics for Pressurized Flying

PROGRESS REPORT

PROBLEM

Possibility of major rupture—by flak or bullets during pressurized flight at high altitudes, or under excessive aerodynamic pressure at high combat speeds.

SOLUTION

New enclosure formed of a laminate of Du Pont "Lucite" methyl methacrylate resin (two outside sheets) and a single separating interlayer sheet of Du Pont "Butacite" polyvinyl butyral resin.

ADVANTAGES

Self-sealing tendencies - penetration is confined to the area of the actual point of impact, and the interlayer of "Butacite" tends to seal the hole or confine it to small size even under pressure. Hole easily and quickly patched in flight with prepared disc of "Butacite."

- Shatterresistance minimum fragmen-
- Good vision—transparency practically tation. equals that of solid acrylic; minimum of ribs and supports.
- Light weight—its specific gravity is less per square foot than solid acrylic sheeting of equal thickness.
- Formability—same as solid acrylics . . . with exception of vacuum drawing, which should not be used for deeply drawn structures.
- Mounting readily adaptable to a variety of techniques.

AVAILABILITY

On any priority rating which secures solid "Lucite" sheeting. Standard thicknesses: 0.400", 0.500", 0.625", each comprising two layers of "Lucite" and one of "Butacite" of approximately equal thickness. Other dimensions on special order.

Formed by: fabricators and airplane companies.

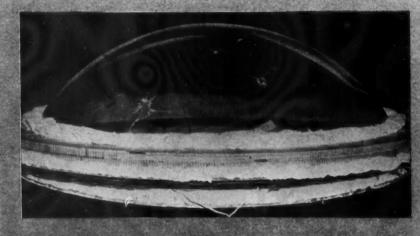
Laminated by: safety glass companies.

Buy more than before . . . in the 5th War Loan

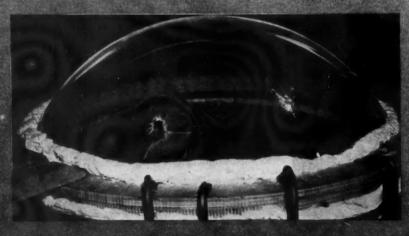


Enclosures of Laminated "Lucite"-"Butacite" Sheeting for Pressurized High Altitude Flying

Pressurized laminated "Lucite""Butacite" enclosure punctured by
a bullet from a 50-caliber gun. Inside air temperature of enclosure
+50°F, outside air temperature
-41°F, internal pressure 5 psi. Size
of hole is small enough to retard
rate of pressure loss and permit
immediate sealing of the hole.



This is another view of the same laminated dome—after being patched, rotated to a new line of the and punctured with another battet from a 50-caliber gun under exact conditions as described above. Note that the patched area remains lated, in spite of pressurization and the shock of a second ballist.



Development work and unlaminated sheet stock by: E.I.du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N. J. Address inquiries to Du Pont in Arlington, or in Canada, to Canadian Industries, Ltd., Box 10, Montreal.



FULL FACTS — A new 28-page "Progress Report" on this laminate provides technical information on proof tests, property graphs, and application. For the designing, specification, forming or fabricating of transparent plane enclosures. Write for free copy on your business letterhead.

DU PONT PLASTICS

Better Things for Better Living ... Through Chemistry

lubrication is a problem. With low volatility fuels, provision must be made for starting and stopping (to clean out lines) on gasoline.

Much of the advantage in power and economy credited to the fuel injection method depends upon how satisfactorily the equivalent carburetor system has been accomplished. Where many starts and stops occur, as in city transportation, it has been reported that an additional 11/2 miles per gallon can be obtained with direct injection of the fuel. This is a considerable saving in view of the present average of carburetor types of 4 to 8 miles per gallon. It is likely that fuel injection

for spark-ignition engines of the oilburning types will have its greatest application in rail cars, power shovels and air compressors; and with the larger spark-ignition gasoline engines in trucks and buses.

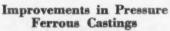
Wartime Developments in the Heat Treatment of Steel and Their Effect on the Design of **Automotive Equipment**

By H. W. McQuaid, Republic Steel Corp.

RECENT developments in heat treating and metallurgical processing indicate that the prospects are good for the production of heat-treated parts

with greatly decreased distortion, with improved useful strength at the point of maximum load application, and with the hardness area localized to insure simpler fabrication in assembly. With sufficient uniformity and with proper selection of steel analysis, this should permit a decrease in size or an increase in loading. There will, however, be no change in modulus of elasticity so that, unless this is taken into account, the problem of deflection will remain and little, actual improvement in performance may be possible. This suggests the value of decreased size where possible, as opposed to increased loading, since decrease in size would probably mean closer spacing of the supports with the resultant decrease in deflection. The decrease in size should also make possible more rigid housings with further decrease in deflection.

The above possible improvement in load-carrying capacity can be traced directly to the improvement in our knowledge of transformation phenomena as developed in the Isothermal and Martempering treatments. It is related directly to improved knowledge of stress intensity and location, and the control or reduction in internal or initial stresses in the heat-treated part. It is also directly related to improved structures resulting from better quenching, from better steel selection, and from control of decarburization. More accurate control of distortion with increased areas of stress application, and hence lower unit stresses due to change in shape during heat treatment, is another contributing factor.



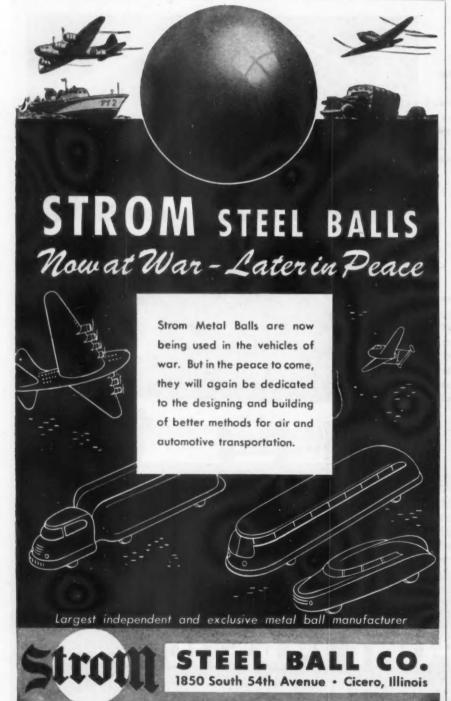
By E. C. Jeter, Ford Motor Co.

BY PRESSURE casting is meant any casting the mold of which is filled with metal under pressure from sources other than gravity. This pressure may be exerted by means of centrifugal force by spinning the mold as a suitable rpm, or it may be obtained by exerting air-pressure on the molten bath from which the mold cavity is filled. The first method is the most widely used at present, however, the latter has many interesting applications and gives promise for the future.

The very principle of centrifugal casting tends to eliminate the possibility of hidden blowholes and shrink cavities sometimes occuring in gravity type castings. In fact, such defects can be entirely eliminated in a properlycontrolled, centrifugal casting process.

Great strides were made in centrifugal casting in steel before the war; gray iron was also successfully shaped into engine cylinder sleeves and brake drums. Since the war began, this method (and related methods) have been used to manufacture such parts as cylinder barrels, gears, tubular sections, front wheel spindles, ball-socket joints, idler hubs, and a wide variety of shapes of irregular section.

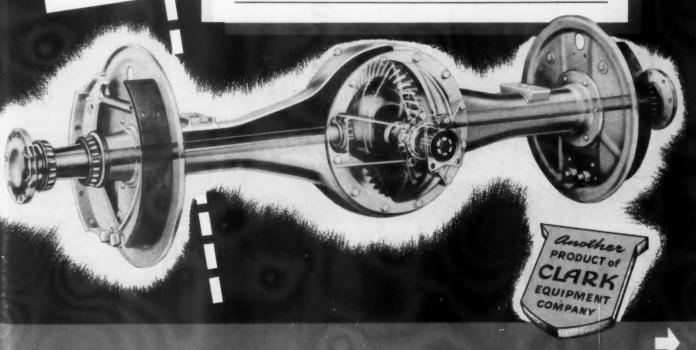
The method of forcing the casting (Turn to page 85, please)

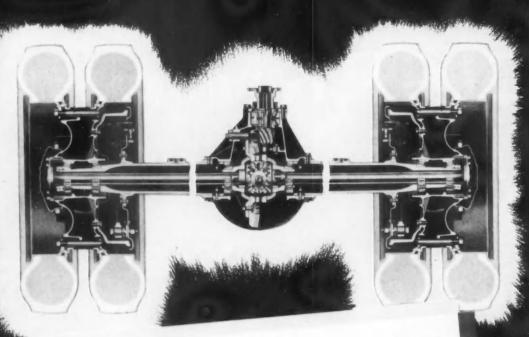


CLARK front and rear AXLES for trucks and busses

BUILT TO DO A BETTER JOB

CLARK FRONT AXLES—NOTED FOR SIMPLICITY, STRENGTH AND EASE OF STEERING . . . CLARK REAR AXLES—FORGED AND HEAT-TREATED ONE PIECE HOUSING MAINTAINS CORRECT ALIGNMENT . . . CARRIER CASTING SPECIALLY DESIGNED TO MAINTAIN GEAR ALIGNMENT . . . DEMOUNTABLE CARRIER UNIT ASSEMBLY PROVIDES EASY ACCESSIBILITY FOR INSPECTION AND ADJUSTMENT . . . PRECISION MOUNTING OF DIFFERENTIAL GEARS AND PINIONS ASSURES CORRECT GEAR ALIGNMENT UNIQUE METHOD OF HEAT TREATING GEARS AND SHAFTS PRODUCES MAXIMUM STRENGTH AND SERVICE ABILITY . . .





FOR DOING TOUGH JOBS WELL

Low cost, trouble-free mileage is built into Clark front and rear axles—built in by 30 years of engineering and close study of operating and maintenance problems, by a basic conviction that fine materials and fine workmanship have no substitute.

Clark's exclusive heat treated housing, and its ability to maintain proper alignment—the strength, rigidity and precision mounting of Clark differentials—the ample size and strength of all axle parts—simple design with easy accessibility of every unit; these are the recognized advantages which have won for Clark Axles an enviable reputation among leading vehicle operators.

With Clark Axles, front and rear, carrying your loads, you'll get the efficient, lasting, economical mileage you have the right to expect. That's a subject well worth discussing with Clark engineers—a discussion that can easily be arranged.

CLARK EQUIPMENT COMPANY

BUCHANAN, MICHIGAN

Also BATTLE CREEK . . . JACKSON . . . BERRIEN SPRINGS, MICH.

CLARK Front and Rear AXLES for Trucks and Busses

another PRODUCT of

EQUIPMENT

COMPANY





metal

has fo machin due to the na extren have | examp can be ing, a finish charge ers ar this m of thi that i

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METAL SPOKE WHEELS

BALLWAY CAR TRUCKS

will July

sign ador

sion engi runi infir metal into its mold under air-pressure has found particular favor where the machinability of the casting is poor due to the nature of the alloy or to the nature of the design. Castings of extreme accuracy and free of defects have been made by this method. For example, a cast unit 2 in. in length can be made within a 0.002 in. tolerance. These parts require no machining, as a rule, and may be cast to finish size when necessary. Supercharger buckets, cutters, hobs, reamers and other parts are being made in this manner. One interesting sidelight of this air-pressure casting process is that it gives the designer a free hand in developing and using creations without regard for machining problems.

Within certain design limits, this method of pressure casting should take its place alongside other well-known methods such as forging and gravity casting. For many types of part it is both economical and of high quality.

Improvements in Static Ferrous Castings

By G. Vennerholm, Ford Motor Co.

WITH the war came the vital need for a variety of new parts formerly made by such means as forging that had to be cast because of the lack of sufficient forging and other special types of facilities. Guns, armor castings, projectiles, and highly-stressed parts for aircraft, tanks, etc., had to be made with the utmost reliability built into them. This called for revisions in casting technique, in the design of shapes to offset shrinkage troubles, the use of higher carbon steels and special alloy materials never before used in casting processes. High speed analyzers of molten metal such as the spectrograph, new types of hardeners and deoxidizers, and the use of X-rays and magnetic methods have helped to yield better castings in a shorter time.

The general tendency appears to be toward standardization of cast steels along the lines of the N.E. (National Emergency) Steels and it is likely that, within a year or so, standard N.E. compositions for cast steels will be in common use.

The Practical Postwar Car

By Wm. B. Stout, Stout Research Div., Consolidated Vultee Aircraft Corp.

NEW and lighter metals, revolutionized production processes and the light, air-cooled engine weighing 2 lb. per hp instead of the present 10 lb. in water-cooled units are a few of the aviation developments that may eventually be translated into car design. With such light engines we may adopt an automatic 2-speed transmission combined with a high horsepower engine or we may go to smaller engines running at higher speeds and with an infinitely-variable transmission which will be designed to keep the engine at its best speed under all conditions of

operation. There should also be great development in electric drives.

The most startling development in postwar cars will be the gradual marriage of the airplane and the automobile as we know it.

The Practical Postwar Car

By Brooks Stevens, Industrial Designer

THE first postwar cars will undoubtedly be revisions of the 1942 models. Conversion from war production can be effected quickly only by the use of existing tools, or some revision of the latter, that were stored away when the war started. Retooling for rear en-

gine vehicles or other radically-styled models would require 18 to 24 months.

The subject of increased vision in postwar cars has come in for some wild predictions. A more practical approach to better vision would be to widen the body at the cowl and move the heavy door and corner post outward and back from its former position. Then we would have nearly 180 degrees driver vision with the use of a two-glass divided windshield.

The much-talked-of rear-engined vehicle has certain points in its favor; however, there are many arguments against it. Such factors claimed for this arrangement as—better vision, less



neath motor drive in its left pedestal and provides 5 fitted drawers for tool attachments, etc.

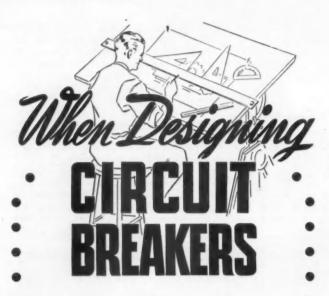
SHELDON

SHELDON MACHINE COMPANY, INC. 4220 N. Knox Ave. Chicage 41, U.S.A.

wall Apron with Power Cross

Feed. The steel Bench com-

pletely houses the under-



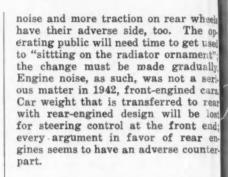
When designing a line of circuit breakers having a wide range of current ratings, selection of the proper type Chace Thermostatic Bimetal will enable you to use one size and shape of bimetal element for the full range of circuit breakers so designed.

By following this practice, one size of circuit breaker will meet a wide range of current demands, provide maximum flexibility in manufacturing control, and reduce your production cost.

Send us detailed information for confidential recommendations regarding the most efficient type of thermostatic bimetal element to use in your overload circuit breakers and other thermal control devices.

W.M.CHACECO

Thermostatic Bimetals and Special Alloys
1610 BEARD AVE • DETROIT 9 , MICH.



Lessons from Aircraft Engines Applied to Heavy-Duty Ground Vehicle Engines

By V. C. Young, Wilcox-Rich Div., Eaton Mfg. Co.

PRESENT aircraft engine design is noteworthy since it stresses refinement and correction of existing parts rather than the creation of new ones It was common practice in ground vehicle engine practice to correct failure of a part by adding more metal or increasing critical sections. The instrument, "factor of safety," had been overworked as a sort of crutch for faulty design. In contrast, airplane engine engineers give meticulous at tention the minutest detail and exert every effort to determine the true cause of failure rather than merely to "fix it." For example, a stud is commonly a cylindrical piece threaded at both ends and having approximately the proper cross-section to handle th tensile stress. Aircraft engineers, after careful study determined that this simple piece should be tapered and shaped especially for the job at hand. Threads were changed from sharpcornered to round-bottom shape. Other minor changes resulted in the ability of the stud to carry a much higher load than the original piece and with greater life.

Careful attention to porting, combustion space temperature, valve opening and seating, and their effect on volumetric efficiency are matters of the utmost concern in aircraft circles. Similar studies of manifolding have disclosed such facts as that solid fuel injection should permit more latitude in valve timing which would have an effect on cylinder charging, and so, volumetric efficiency.

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Possibilities of Aircraft Structures in Ground Vehicles

By Mac Short, Lockheed Aircraft Corp.

THE possibilities of aircraft type structures are latent in commercial ground vehicles, but nevertheless existent and there is a growing tendency among commercial vehicle designers to utilize portions of the structure in functional formation, to give as many of them as possible multiple purposes. Probably, of all commercial ground vehicles, the cross-country or inter-city (Turn to page 90, please)



IT'S LIKE GIVING YOUR ASSEMBLY LINE A SHOT IN THE ARM TO SWITCH TO THE SCREWS WITH THE ENGINEERED RECESS THAT SPEEDS UP ASSEMBLY AS



Manufacturers in every industry can tell you that switching to Phillips Recessed Head Screws acts like a tonic to assembly lines.

To start with, you get faster much faster - screw driving. Comparisons made in scores of plants prove that Phillips Screws step up fastening speed as much as 50%.

Next, Phillips Recessed Head Screws save precious man hours. The scientifically Engineered Recess utilizes the worker's full turning power and skill. Time and muscle are not wasted on wobbly starts, slantwise drives and dangerous driver skids - nor on correcting sloppy work.

Finally, with all this increased speed, you get vastly better work-manship. Phillips Recessed Head Screws make driving so simple, so steady that the most inexperienced operator soon becomes master of

the trickiest fastening jobs!

If these are the kind of results you'd like, but aren't getting from slotted and other type screws, you owe it to yourself and to your workers to switch to Phillips - the screws with the Scientifically Engineered Recess. They cost less to use ... because they help you produce much more. Any one of the 23 manufacturers below will enable you to prove it in your own plant.

TO MAKE WARTIME **QUOTAS AND** PEACETIME PROFITS

uster Starting: Driver point automatically centers in the Phillips Recess . . . fits snugly. Fumbling, wobbly starts, slant driving are eliminated. Work is made trouble-proof for ereen hands.

Faster Driving: Spiral and power driving are made practical. Driver won't slip from recess to spoil material or injure worker. (Average time saving is 50%.)

Easter Driving: Turning power is fully utilized. Workers maintain speed without tiring.

Better Fastening: Screws are set-up uniformly tight, with-out burring or breaking of screw heads. The job is stronger, and the ornamental recess adds to appearance.

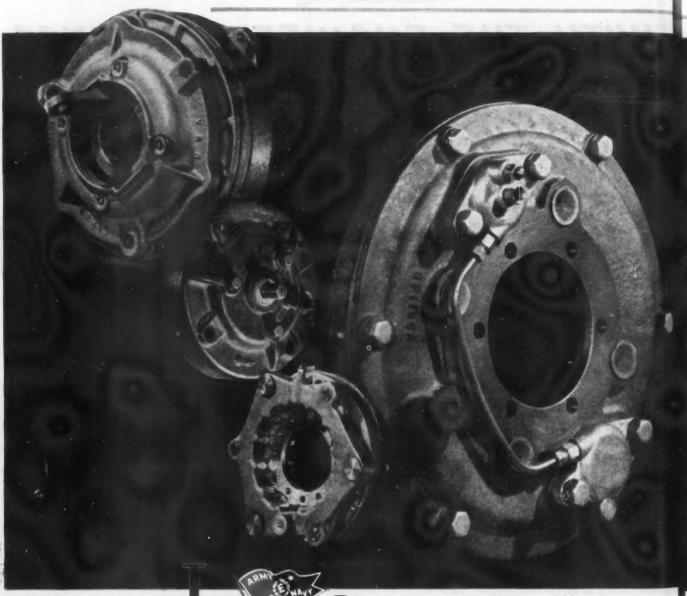








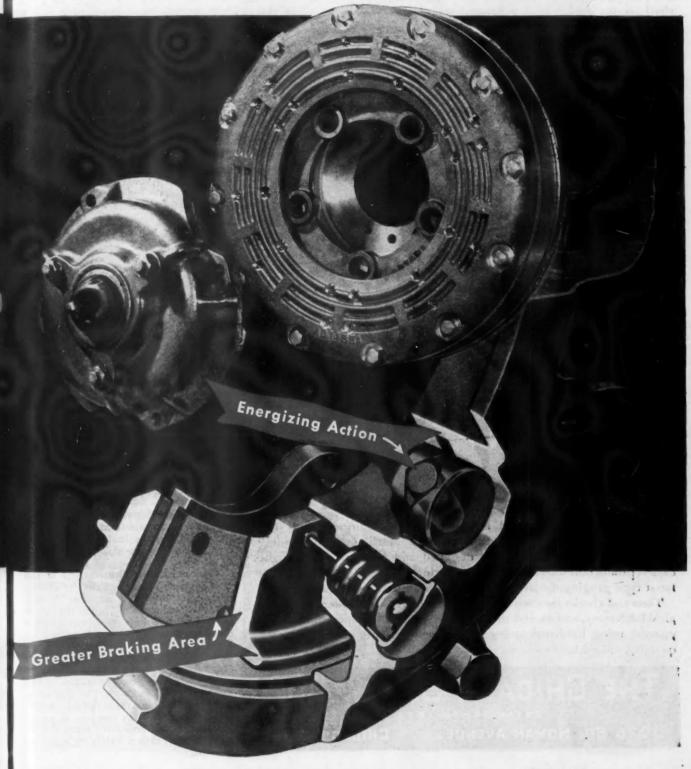
They're Ready NOW for Post-War Applications



Lambert Air Mydraulic Mechanical DISC BRAKES

- Illustrated here are a few of the many types of Lambert Disc Brakes which will be available for Tractors, Busses, Trucks, Passenger Cars, Airplanes and Industrial Machinery.
- In these Lambert Disc Brakes are advancements long sought by manufacturers...brakes which harness momentum...provide additional braking power...require less pedal

pressure...insure equal efficiency in stopping backward and forward motion...eliminate drum weight and scoring. Long before the war, these brakes began proving themselves in the field as standard equipment brakes on thousands of tractors. They are ready now for your investigation and tests. Auto Specialties Mfg. Co., St. Joseph, Michigan.



bus presents the most opportunities to explore the possibilities. It is understood that frameless chassis of light alloys have been used extensively where the body is the main structural element. Also, it has been noted that considerable care has been exercised in locating doors and reducing the size of the windows.

For a representative modern 37-40 seat bus, the body structure has been reported to be about 38 per cent of the empty weight. It is of interest to note that the comparable body structure of a 21-24 passenger air transport is about 35 per cent. Both designers, therefore, have available nearly equal

structural percentages on which to apply their ingenuity. Another comparative value is that the weight of body

structure (plus fixtures), per passenger, is very nearly the same—183 lb for bus and 194 lb for air transport,

Our Crude Oil Outlook

(Continued from page 20)

by its proponents and attacked by those who see in it the beginning of progressive encroachment on free private enterprise, the proposed financing of the 1250 mile long pipe line in Saudi Arabia with U. S. Government funds promises to bring much needed clarity into consideration of what, after all,

is the basic problem to be solved. Are we really, as claimed by some, only a score of years away from a complete drying up of American crude oil resources, and if so, what is the economically sound approach to the problem of averting or overcoming such a calamity? This all-important question has not yet been answered. This bird'seye view of the crude oil situation may be helpful in forming a worthwhile opinion on the subject.

Second Article to Follow in an Early Issue

Aeroproducts Division of ' GM Receives New Contracts

Aeroproducts Division of General Motors has received a new contract to supply its four-bladed, automatic, constant speed propellers for the P-51 Mustang, world's fastest airplane, according to a recent announcement.

While the Aeroprop's production since the Dayton, Ohio plant first got under way in December, 1941, has been limited chiefly to the Bell Airacobra P-39, the assignment to the P-51 is said to be the forerunner of expanded use of the new propeller design. In addition, Aeroproducts Division is the exclusive producer of automatic, constant speed Aeroprops for the new Bell Airacobra P-63 fighter plane.

One distinguishing feature of the P-63 is the big, four-bladed propeller, while the P-39 is equipped with a three-bladed Aeroprop. The P-63 utilizes the hollow shaft hub of the Aeroprop for installation of its nose cannon.

Mass Production

(Continued from page 33)

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for its size and gives long service. In addition, it is said that neither wear nor slight change in tolerance of the mounting affect the ability of the joint to function.

Referring to the illustrations of the heat treating equipment for the shafts, it may be noted that the work is first hardened and quenched; then the spline is drawn at a high temperature, followed by drawing the entire piece at a lower temperature. This procedure has been found to improve physical properties and to prevent distortion.

One of the interesting features of the machine shop layout is the use of a long monorail conveyor which transports shafts from the machine shops on one floor to the broaching machines on a lower floor, thus simplifying material handling.



Precision in production and testing has been traditional with The Chicago Screw Company for over 72 years . . . Machining and grinding on modern precision equipment designed and built to maintain the closest production tolerances, plus inspection after each operation on the latest type gauging devices — adds up to a uniformly accurate product.

Tests and checks start with the raw material in our modern metallurgical laboratory, and extend throughout all secondary operations . . . If you are using hardened and ground screw machine products, in any quantity, we are here to serve you.

THE CHICAGO SCREW CO.

ESTABLISHED 1872

1026 SO. HOMAN AVENUE

CHICAGO, ILL.



In engines for combat planes, trainers, and transports—in landing gear and controls—in transmissions and final drives of tanks and amphibians—in trucks, ducks, jeeps and gun mounts—Bunting Cast Bronze Bearings are doing extraordinary duty in modern war.

For the future machines of peacetime Bunting will offer the advanced Cast Bronze Bearings which war has helped to develop.

Finished bearings, ready to install in machinery of every kind, and Bunting Factory Finished Tubular and Solid Bronze Bars are available from stock. Ask your wholesaler. Write for catalog.

For special bearings, engineered to your particular requirements, our engineering services are promptly and gladly available...The Bunting Brass and Bronze Company, Toledo, Ohio. Warehouses in Principal Cities.

BRONZE BUSHINGS & BEARINGS & PRECISION BRONZE BARS

New Products for Aircraft

(Continued from page 48)

The new fuel cells will provide protection against leaks caused by loosened rivets or seams and will resist the effects of minor crashes. For the present, the bladder-type cells will be custombuilt for each airplane.

Aircraft Junction Boxes of Aluminum

More than 200 aircraft junction box assemblies, ranging in size from 1% in.

by 1% in. up to 23 in. by 15 in., have been grouped into a standard line by Poulsen & Nardon, Inc., Los Angeles, Cal. Of aluminum construction throughout, the junction box assemblies are used for aircraft electrical installations.

Material thicknesses are from .032 in to .064 in. in 2SO or 3SO aluminum. Covers to fit are supplied in 3S½H aluminum. Boxes and covers can be supplied with conventional nut plate and screw type fasteners or other types of fasteners on request.



Aircraft junction box made by Poulsen & Narden

Typical of this standard line is the junction box illustrated, size 7½ in. by 5 in. by 2¼ in., of .051 in. 2SO aluminum, with cover attached.

Rubber Mounting for Aircraft Engines

The Goodyear Tire & Rubber Company, Akron, Ohio, has developed a rubber mounting for the engines of Flying Fortresses.

A number of the mounts are used to attach the engine to its tubular mounting ring. Each mount consists of two main parts. There is a collar, lined with a rubber bushing. This collar is attached to lugs welded to the ring. The collar has a socket which is at right angles to the collar itself. The



Goodyear mounting for aircraft engines

other half of the mounting, a small unit attached to the engine, ends in a ball which fits into this socket.

Vibrations developing in the engine are isolated by two features of the mounting, the ball and socket joint, and the rubber bushing in the collar. The ball and socket, as used, produces a unique rocking motion in the rubber bushing.

Laminated Lucite Butacite

A new three-ply laminated plastics sheeting designed to give added protection to airmen flying in pressurized high-altitude planes has been brought out by E. I. du Pont de Nemours & Company, Wilmington, Del. The new sheeting reduces the possibilities of disintegration of clear plastic canopies when pierced by bullets or flak while flying at high speeds under pressurized conditions.

Called laminated "Lucite"-"Butacite," it consists of a single layer of "Butacite" polyvinyl butyral resin sandwiched between two layers of "Lucite" methyl methacrylate resin. An impor-





The advantages of BLANCHARD grinding

- *Production
- * Adaptability
- *Flatness
- **Fixture Saving

 Operation Saving

 Material Saving

 Fine Finish
- **★Close Limits**



*Production *Adaptability *Flatness *Fixture Saving *Close Limits

Grinding Valve Plates, Discs, Cylinder Heads, Eccentric Straps This picture shows a variety of pieces, of cast iron, steel and bronze, ready to be ground on the No. 18 Blanchard Surface Grinder.

Most of these pieces are to be ground on two sides, the usual limits being $\pm .0005''$ and the amount of stock removed from .015" to .020" per surface.

So adaptable is this machine that new ways of employing it profitably are being continually found and the expression "Put it on the Blanchard", becomes more and more familiar.

"Put it on the Blanchard"

This job being done on the



No. 18 Blanchard Surface Grinder



Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

The BLANCHARD MACHINE COMPANY

64 State St., Cambridge 39, Mass.



THESE FEATURES EACH MONTH

- * Welding Metallurgy
- * Cost Analysis
- * Welding Design
- * Production Ideas
- * Salvaging Tools
- * New Maintenance Economies
 - ★ Useful Tricks
 and Tools

For

WELDERS • ENGINEERS

... Created to disseminate factual information and knowledge gained from the experience of successful users of EUTECTIC Low Temperature Welding, the new welding process which is gaining wide acceptance in production, salvage and maintenance. All metals from aluminum to zinc die-castings can be joined by this process. Applicable with oxy-acetylene torch, metallicarc, induction and furnace heating.

The EUTECTIC WELDER is prepared by the engineering and research staff of The Eutectic Welding Alloys Company, and supplemented by contributions from users of the process in all fields.

Welders, welding engineers, and metallurgists have acclaimed the arrival of The EUTECTIC WELDER. An engineer writes:

"Found your publication a real boon to our welding department. Please add the following names to your list and make sure to send us current issues every month." tant part of the problem was the development of a special adhesive to accomplish the lamination.

Improved Simlok Fasteners

Simmons Machine Tool Corp., Albany, N. Y., has improved the design and construction of its Simlok fasteners for cowling and panels. The improved fastener is manufactured in three sizes with three types of studs; flush head, oval head, and wing head. Its tapered design is said to make it particularly valuable in assembling curved sheets, such as engine cowlings, as the assembly is forced into alignment before the fastener be can be locked. Side play



Simlok fastener

is eliminated, and end play or spring deflection is held to a maximum of .008 in., or just enough to lock the fastener.

Simlok is constructed with a hollow inner one piece housing which is integral with locking lugs. It is casehardened to minimize wear. Inside is a long-travel helical spring which ejects the fastener when unlocked. An outer housing retains the spring and the inner housing as a complete assembly. A locking ring makes possible permanent installation where desired.

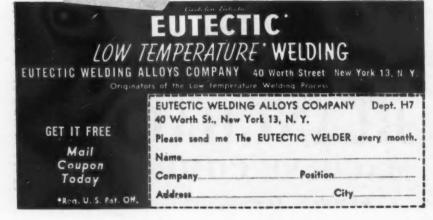
To lock, the two sheets are brought together so the stud enters the receptacle. Then the stud is depressed against the spring action and turned until it rides under the cam surfaces. It locks in a seat in the cam.

Portable Hangar

Simplicity of erection and saving of critical materials are among the advantages claimed for a new portable steel hangar building designed and manufactured by The American Rolling Mill (Turn to page 98, please)

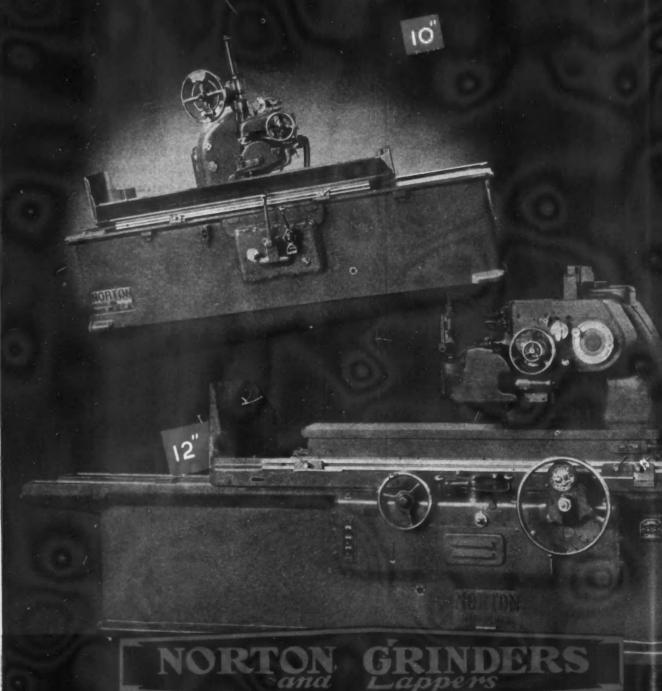


Portable steel hangar made by The American Rolling Mill Co.





For recision_ Surface Grinding



NORTON GRINDERS COVER WIDE RANGE

. for Production or Tool Room Surfacing

WHERE surface finish and dimensional accuracy must be better than average and production must be maintained at high levels, the Norton Surface Grinder fulfills the requirements of accuracy, and provides fast, convenient operation.

All the machines in the Norton line of Surface Grinders — in 6", 10" and 12" capacities — are precision-built for precision work. There is no sacrifice of stamina, however, and these surface grinders have an enviable record of long-lived, high-production accuracy.

Hydraulic operation is featured, with controls concentrated for operator convenience. Hand feeds supplement smooth power movement. Time-tested design gives easy adjustment and reduces maintenance to a cost-saving minimum throughout the full line of Norton precision-built Surface Grinders.

NORTON COMPANY, Worcester 6, Mass.



Co., Middletown, Ohio. It is capable of carrying a higher load per pound of steel than any other current designs.

Two sizes of hangar have been built to date, one with an inside width at the base of 152 ft and a height of 36 ft 7 in.; the other with a width of 192 ft and a height of 48 ft. The length may be any multiple of 17½ ft.

The arches, assembled at ground level, are made up of pressed metal units bolted together into segments that are identical and interchangeable. These circular arch rings weigh a maximum of 3 and 7 tons and are hinged to a corrugated base plate. By means of two 40-ft poles, two sheaves and a

winch truck, an arch ring can be raised within 15 minutes.

Space between the arches is covered with standard Steelox panels. These span from arch to arch, serving both as purlins and roofing. They are bolted to the top chord of the arches. The ends of the hangar, including the doors, are built of Steelox panels.

Swivel Type Flush Riveting Set

A swivel-type flush riveting set, designed for flush riveting on irregular or slightly curved surfaces, is now in pro-



Emerson riveting set

duction at the Emerson Engineering Co., Los Angeles, Cal.

Swivel action allows riveting from various angles up to 20 deg., while a protective rubber cover prevents skidding or danger of surface marring. Ample face and high polish assures smooth skin finish. The sets have 1½ in. face with an overall length of 3 in. and are available with either .401 in. or .498 in. shank.

The set consists of only three parts, head shank and rubber retainer. The set can be assembled or disassembled easily by hand.

ASTM Nominates Officers

P. H. Bates, Chief, Clay and Silicate Division, National Bureau of Standards, and Arthur W. Carpenter, Manager, Testing Laboratories, The B. F. Goodrich Co., have been nominated as president and vice-president, respectively, by the American Society for Testing Materials.

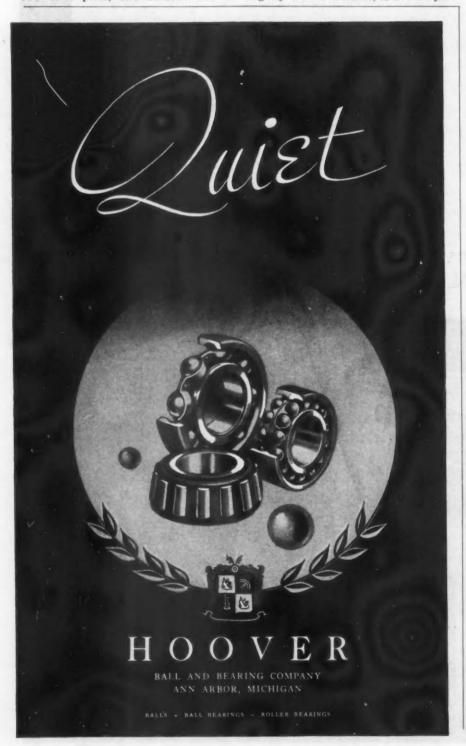
New Plastic Bubble Shields Fighter Pilots



SPR tion of watches of the these Knigh

contrib Ameri erful i

A single sheet of ultra-transparent plastic, blown like a soap bubble by a radically new "air-forming" technique now gives Republic Thunderbolt pilots improved vision in all directions, cuts weight and thus increases range, speeds up assembly and reduces wind-resistance and drag. Now in mass production at the Bristol, Pa., plant of Rohm & Haas Company, the one-piece Plexiglas canopy eliminates the struts and frames formerly used, and is actually more transparent than window glass.



"Muscles" BY Millions





SPRINGS are mechanical "muscles." They are essential to the proper operation of every mechanical device—from watches to warships. Our position as one of the World's Largest Manufacturers of these important items and our ability as Knights of Production is allowing us to contribute heavily to the job of making America's fighting machine the most powerful in history. We're proud of our privi-

lege—and our ability—to manufacture these spring "muscles" by the million. Due to our vast experience in manufacturing war material, we are learning to make them better than ever... to help you make finer products when peace returns.

Alfanna



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Branch Plants

CHICAGO, LOS ANGELES, OAKLAND, CALIF., TRENTON, N. J.,
TULSA, OKLA., AND IN TORONTO AND WINDSOR, CANADA



Will Adequate Postwar Rubber Be Available?

(Continued from page 40)

that after complete re-possession, the first year will not produce over 400,000 tons of rubber and the second year not more than 700,000 tons. It may require two more years to reach 1,500,000 tons output. Therefore, if re-possession is complete by the end of 1946, the available world supply for the following four years, as compared to the demand, may be as follows:

TOTAL WORLD RUBBER SUPPLY AND DEMAND—LONG TONS

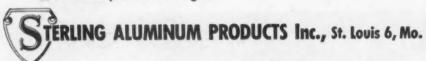
	1947	1948	1949	1950
Demand	1,526,500	1,701,000	1,900,000	1,900,000
U. S. A. Synthetic Prod	1,075,000	1,075,000	1,075,000	1,075,000
Rest of World Syn. Prod. Plantation Production Wild Rubber	400,000	150,000 700,000 40,000	1,100,000 25,000	1,500,000 25,000
Total Supply Deficit or Surplus	+148,500	1,965,000 +254,000	2,200,000 +300,000	2,690,000 +700,000
Required for inventory and in transit		200,000	100.000	



CAN BE INTRICATE YET SATISFACTORY Let STERLING Engineers Show You How

Many years of designing permanent molds for aluminum castings have made Sterling engineers specialists in this type of work. Designs you may have thought too intricate to cast will be welcomed by Sterling engineers. You may get a solution that will lower your cost and improve the quality of your product.

Why not submit your specifications for today's production or postwar designs.



If we assume that 200,000 tons of rubber may be found in native possession in the East after re-conquest, the 1947 surplus will be 148,500 which, if carried over to 1948, would leave a surplus for that year of 202,500 tons. This surplus would be wiped out by failure to find rubber in native possession which would carry the deficit to 1949.

Granted the validity of our reasoning thus far, the world may be facing a tight rubber situation for nearly four years after the war, unless we see fit to expand further our synthetic output. This is quite a different view from the one frequently expressed that, postwar, the market will be flooded with cheap crude which will drive synthetic out of existence. It is important, because it means that synthetic must not only meet our war needs, but must be able to cope with a large portion of our postwar requirements and all the changed conditions under which rub-ber products will be used. It is likewise evident that synthetic has five or six more years in which to become competitive, in cost and quality, with the natural product.

Then there is the matter of cost. When a commodity can be delivered to the United States' market for three years, as in 1931-33 (see Fig. 3), at average yearly prices of 6.1 cents per pound, 3.4 cents per pound, and 5.9 cents per pound, it raises some questions in the minds of those who know that synthetic rubber (GR-S) of the most abundant type probably costs between 40 and 50 cents. Several authorities have stated that crude rubber can be produced on high-yielding efficient plantations and sold at a profit in this country for from 10 cents to 12 cents per pound. Statements have been made that the cost of crude production might even be brought below 4 cents per pound. Other authorities state that synthetic may be produced at a cost of from 12 cents to 16 cents per pound. Certainly we must examine these possibilities, in our attempt to define a postwar picture.

An efficient large estate, with highyielding trees could lay down rubber in New York before the war for about 11 cents per pound, with about 1 cent profit. A considerable proportion of large estates could not do as well.



* FOR A NEW AND BETTER

AMBRICA

BOWER ROLLER BEARINGS



HYDRAULIC PRESSES EVERY PURPOSE VALVES AND FOR

It

quan

July

Small native estates have little fixed investment and small labor costs. On a low market, these are the most tenacious of the plantation rubber producers. Except for these small operators, it is likely that the plantations, postwar, will be faced with much higher costs. Labor rates will likely increase from 50 per cent-100 per cent with corresponding increases in costs of management and administration and much greater increases in local taxes. An increase of two to four cents a pound would not be unexpected, particularly in the early years, after rehabilitation. This would mean a New York cost of from 13 to 15 cents per pound. Continued lower prices might make all the rubber "go Native."

GR-S synthetic cost of between 40 and 50 cents a pound at present is chiefly because of high-cost alcohol used in making butadiene and because of initial operating inefficiencies. It is estimated that butadiene and styrene can each be produced at about eight cents per pound by efficient methods. With plant values adjusted to postwar replacement costs, rubber could be produced for 151/2 cents. The cheapest source of industrial alcohol would appear to be from molasses imported from the West Indies. It may be important in the postwar period to retain two basic sources of butadiene supply, both from the standpoint of future economies and because of butadiene plant equipment now in use. The importation of molasses (or inverted sugar) on an adequate scale would, with by-product utilization, appear to offer promise of butadiene at least competitive with the petroleum supply and perhaps cheaper. These or other cost improvements are certain to come before any large surplus of rubber is available.

It would seem, then, that the elements for cost competition, between natural and synthetic rubber, are inherent in the situation. It remains to be seen which product wins the cost battle. However, the synthetic process has the well-known advantage enjoyed by chemical processes, in that it is capable of being changed quickly and relatively cheaply. It seems certain that synthetic will check wild price fluctuations and tend to create a progressive decline in rubber prices. The competitive quality of synthetic has every opportunity for improvement, in the hands of a progressive technical Continued large demand industry. over a period of several years, provides all the neecssary justification for technological improvement. Increased processing costs in the rubber goods factories are being reduced and should soon be competitive.

It is worthy of notice that, if the synthetic consumption figures, here indicated as future possibilities, are realized, there are many accessory materials which must be provided in large quantities, for more than the emer-

gency war period. Such items as carbon black, rubber accelerators and rayon fabric are used in greater quantities with synthetic than with natural rubber. In some cases the productive capacities are inadequate or are being supplied on an emergency conversion basis. Manufacturers of these materials have been reluctant to plan permanent expansions in view of the general belief that they would be superfluous after the war. Such manufacturers and their customers would do well to reconsider the whole situation in the light of a more permanent demand.

Resume Airport Projects

Approval by the President for proceeding with the construction of 14 airports required for specific military purposes and 27 for emergency use was announced by the Secretary of Commerce, Jesse H. Jones.

This action was based on the results of a survey of projects in the National Defense Landing Area Program which had not been started or upon which no substantial amount of construction had been accomplished in order to determine which airports might be eliminated because they were not a necessity.



New Precision Step Drill Grinder Simplifies Production and Maintenance of Step Drills

The quality of a step drill produced by common methods depends almost entirely on the skill and attention of the individual tool maker. However, with the development of the precision step drill grinder, the human element has been entirely eliminated, the characteristics of the step being completely controlled by the grinding machine without adjustments during the course of grinding. This automatic feature insures absolute uniformity, regardless of quantity, and permits large-volume production of step drills.

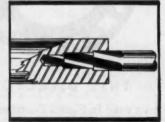
The apparent advantages gained through the

volume production of step drills.

The apparent advantages gained through the use of the step drill grinder are: Permits mass production of drills ground to exact specifications, entirely independent of the human element. Maintenance, too, is no longer an obstacle as step drills produced by this method are quickly sharpened by the same uniform machine-controlled operation. With the step drill grinder step drills can now be made from standard drills. These advantages result in a wider application of step drills which provide a definite saving of machine tools, man-hours and cost; this in turn results in greater production.

and cost; this in turn results in greater production. You know there are plenty of benefits in chewing gum, too. That's why all of the Wrigley's Spearmint we're able to make from our available stocks is going overseas to our fighting men and women. You know what a lift it's been on the job and we wish we could supply everybody, because we have pride, too, in our workmanship and productivity. But there just aren't enough available top quality raw materials right now to do it. When we can produce it in sufficient quantity, it will be back to you with the same fine flavor and chewing satisfaction ... Wrigley's Spearmint has never been changed! You can get comblete information from Shiral Mfg.

You can get complete information from Spiral Mfg. Corp., 5022 North Kedzie Avenue, Chicago 25, Ill.



The above illustration shows mechanical design which requires a hole having diameters diminishing in steps. This is an operation for step drills which has often been neglected due to difficulty in obtaining and maintaining step drills.



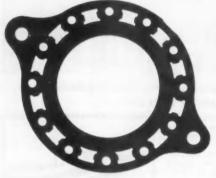
Step drills produced by our method are quickly sharpened by the same uniform, machine-centrolled method.

Y-125

COMMUNICATIONS MUST NOT FAIL!

In the cold of the North ... in the heat of the South ... in the humidity of the jungles ... in the dryness of the desert!

BEACH OFFICER, WITH WALKIE-TALKIE RADIO, COORDINATES ATTACK DURING AFRICAN CAMPAIGN.



CONTINENTAL-DIAMOND

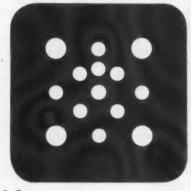
Electrical Insulating Materials are engineered to retain stability from 70°F. below zero to 160°F. above zero. Bulletin GF gives complete technical data on all C-D products Dilecto—Dilectene—Vulcoid—Diamond Fibre—Celoron.

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part used in Signal Corps equipment is an intricate punching... engineered to stand up under severe mechanical stress as well as electrical and thermal extremes.

THIS DILECTENE

part used in Military radio equipment has especially low loss factor... and its electrical and mechanical properties are stable over a wide range of frequencies.



CT-44

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HOW WE DETECT STEEL FLAWS IN ARMATURE SHAFTS... for Precision-Built Aircraft Motors



EMERSON-ELECTRIC AIRCRAFT MOTORS are made for gun turret drives, hydraulic units, fuel pumps, actuators, winterizing units, communication systems—also with built-in gear and magnetic brake.

Specifications for many types of aircraft motors require exacting tests of raw materials, and at every stage of production. Magnaflux testing of the steel in armature shafts is one of these requirements.

The shaft is first magnetized and then sprayed with a special mixture of iron powder and oil. The shape of any surface flaw is plainly indicated by the pattern of the iron powder which adheres to the shaft directly over the imperfection.

Rigorous inspection operations of this type have had much to do with the success of Emerson-Electric Aircraft Motors in meeting specifications and the severe service requirements on combat aircraft.

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PAGE Welding ELECTRODES

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MAKING electrodes is highly technical work.

Analysis of the wire—type, thickness, hardness and concentricity of the coating—all chemical and physical characteristics must be held to close tolerances to insure uniform welds and satisfactory production.

To you, the very fact that PAGE WELDING ELECTRODES have been hard to get is proof that they measure up to the highest standards. Here's why:
PAGE has been turning out a bigger tonnage of electrodes than ever before in PAGE history. And they have all been used on work that had to pass the closest scrutiny of Army, Navy and Air Corps inspectors. They have had to be good!

As more and more of PAGE'S volume begins to flow into civilian manufacturing, it will become evident that PAGE is making even better welding electrodes—of all types—than ever before. That's why it will pay you to get in touch with PAGE.

Ask the local PAGE distributor about PAGE Hi-Tensile "C" Electrodes—as well as the complete range of PAGE-Allegheny Stainless Steel Electrodes.



PAGE STEEL AND WIRE DIVISION

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Six foundries in four cities:

Muskegon—Henry Street Plant Sanford Street Plant C.W.C. Crankshalt Corporation.

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Bettendorf, Ia. — Ordnance Steel Foundry Co.

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ONE OF MANY C.W.C. CONTRIBUTIONS TO BETTER ENGINE DESIGN

Like many other C.W.C. developments in metallurgical engineering, Proferall* Camshafts, cast of electric furnace alloyed metal, have permitted engine builders to incorporate improvements formerly impossible because of limitations imposed by other manufacturing methods.

Offering to engineers unrestricted freedom of design, and to management unlimited opportunity for production economies, C.W.C. castings of electric furnace alloyed metal may contribute immeasurably to your program of product improvement.

Progressive metallurgical research and engineering have given remarkable physical characteristics to C.W.C. electric furnace alloyed metals and revolutionary innovations in casting techniques permit their fullest utilization.

A discussion with experienced C.W.C. engineers and metallurgists may disclose many opportunities for using castings in your product.

Write C.W.C. for complete information. Ask about C.W.C. electric furnace alloyed metals and C.W.C.'s immense facilities for handling volume casting contracts.

*Cast of Proferall (PROcess FERrous ALLoy)

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Than Ever
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Master stocks in 38 NAPA warehouses. Jobbers everywhere give prompt service.

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SPEED and ECONOMY

Du Pont Potassium High-Speed Copper Plating

NOW it's possible to get better High-Speed Copper Plating at lower cost. A new development from Du Pont—RH 661— Potassium High-Speed Copper Plating Salts—permits use of considerably lower metal concentration in copper plating. And that means economy. The bath made up with RH 661 is very stable over a wide operating range. NO POISONOUS OR OBJECTIONABLE FUMES ARE EVOLVED. Heavier and smoother copper deposits can be obtained commercially because the tendency to form nodules has been reduced.

In addition, the low metal concentrations which are a feature of the RH 661 bath mean smaller drag-out losses, easier rinsing, less tendency to pit, greater bath stability and

less tendency to burn at current densities exceeding the normal bright range.

Speed and deposit appearance are similar to those obtained with regular High-Speed Copper. The bright, dense deposits are suitable as under-coatings for all types of bright nickel plating; as protective and stop-off deposits for localized or selective hardening.

Du Pont Potassium High-Speed Copper Plating Salts—RH 661—can be used without changing your present cyanide plating equipment. For further information on adapting these salts and process to your needs, write or call: E. I. du Pont de Nemours & Co. (Inc.), Electroplating Division, Wilmington 98, Delaware.

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DU PONT CHEMICALS . PROCESSES . SERVICE

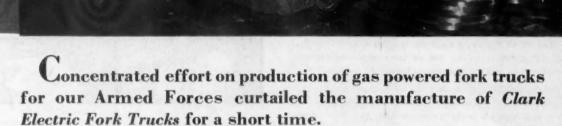
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are Back... and Available



Increased productive capacity enables us to again serve the needs of Industry for dependable and proven electric fork trucks.

CLARK ENGINEERED and CLARK BUILT

If you need an electric fork truck NOW, phone, wire or write.



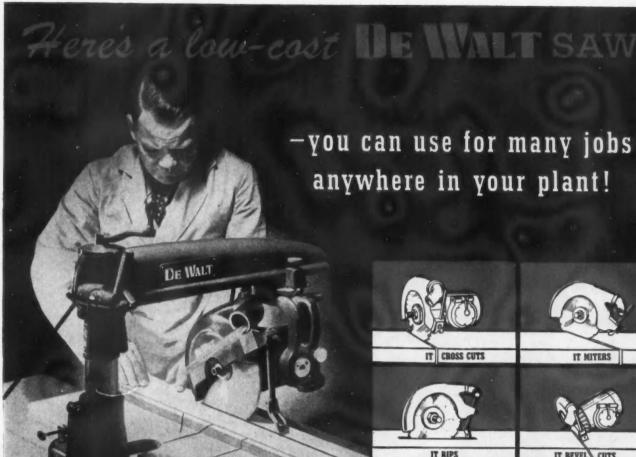
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BATTLE CREEK, MICHIGAN, U.S.A.

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STRAIGHT RIPPING

Here's the latest innovation in wood-working machinery!

DeWalt is the answer to industry's need for a safe, easy-to-operate, adjustable, precision cut-off saw—for use in carpenter maintenance, pattern work, crating and boxing, and production wood cutting.

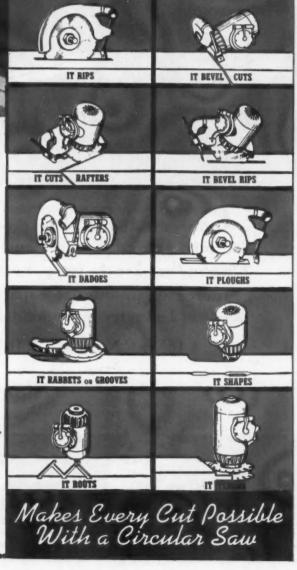
DeWalt is the ALL-PURPOSE machine that can be changed quickly, as required, from a straight-line cut-off saw—to miter saw—to rip saw—to dado machine—to shaper—or other operations that can be made with circular cutting tools.

No matter how, where or when you cut wood, there's a DeWalt that will reduce your cutting costs, conserve labor, simplify materials handling, save floor space, eliminate waste and actually reduce your investment in the wood-working machinery you require.

Illustrated above is the smallest of our many models. It is available in two sizes complete with motor: $\frac{1}{2}$ HP one phase, AC, \$125.00; $\frac{9}{4}$ HP three phase, AC, \$135.00. The complete DeWalt line ranges up to 10 HP.

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INSIDE—note the trim compactness and ample wiring space.

OUTSIDE — modernly streamlined cover with rocker design bandle. All BullDog Safety Switches have two important (and exclusive) advantages which assure more positive action, greater safety and longer life.

First, the Vacu-Break principle gives arcs no space in which to breathe — snuffs them out before they start.

Second, the Clampmatic mechanism — bolt-tight in the ON position—makes possible an easy, quick release when thrown OFF. This is accomplished by the energy stored in the clamp springs which help the handle operating spring "break" the contacts with almost automatic ease.

Send for descriptive Bulletin No. 415, giving complete information.

BULLDOG

BOX 177, R. PK. ANNEX DETROIT 32, MICHIGAN BuilDog Electric Products of Canada, Ltd., Toronto, Ont.



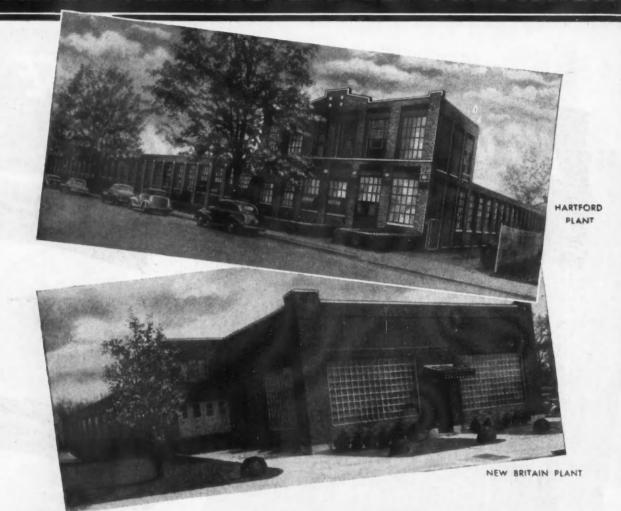
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Building War Products Today Peace Time Products Tomorrow

Fenn Plants, wholly engaged in war production today, will, when peace comes, continue building special machinery, in which they have majored for three generations. If you are thinking of building new machines or remodeling old ones, it's time to plan Now.

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sub-assemblies for planes, artillery and other

Fenn Plants are delivering precision parts and vital war equipment to practically every industrial center.

FENN FOR SPECIAL MACHINERY

Fenn designers and engineers have solved many * knotty problems in machine design, resulting in efficient, profitable production. Fenn has the men

and experience to handle almost any machine design job. Consultation is invited and involves no obligation.

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Heavy Duty Fuel Lines

.. FOR HEAVY DUTY TRUCKS

You can't compare any other oil or gas line with Titeflex—because no other line is made like Titeflex.

Unlike ordinary flexible lines, Titeflex is all metal. No packing. No composition materials. Nothing that can be affected by high engine temperatures or by the damaging effects of oil, gasoline, and moisture.

Then, for further protection, Titeflex construction provides not one but 4 thicknesses of metal at point of greatest wear... provides a metal braiding woven onto the line itself for greater strength and greater durability...

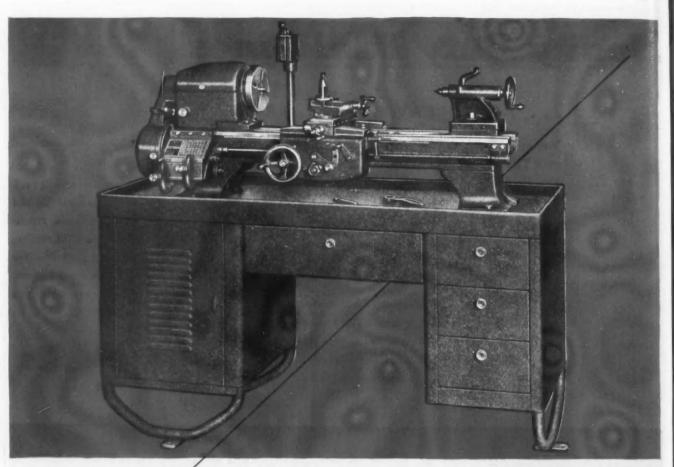
provides a flexibility that withstands constant, grueling vibration.

Add these features together and you'll realize why Titeflex has been a "natural" for the trouble free operation of tanks, jeeps, trucks and other vehicles of war. And you'll realize, too, that Titeflex is the logical fuel line for the heavier vehicles which you manufacture. Why not have Titeflex engineers send you complete information—now?

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With Automatic Apron

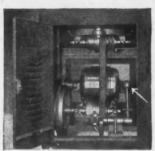
The Logan Cabinet Lathe is particularly adaptable to tool room work, for maintenance, for training, or for production. It is not only built with features and to standards of precision that are outstanding in its field, but it also has the durability to stand up under continuous production use. The carriage with friction-feed automatic apron travels over a rugged, warp-free bed that is ground to within .0005" of absolute accuracy. The total run-out of its headstock spindle 12 inches from the bearings is less than .001". The lead screw is held to within .002" in 12 inches. The spindle turns on a double row of preloaded, grease sealed ball bearings, and at 40 other vital points throughout the lathe friction is minimized by self lubricating bronze bearings. Four large drawers in the strong tubular steel cabinet may be used for tool storage. Each drawer has an individual lock. Left hand compartment contains underneath motor drive and countershaft. The entire cabinet stands on a 3-point base, assuring a steady installation on any floor. All moving belts and gears are completely enclosed. Ask your Logan dealer or write for catalog information.



LOGAN ENGINEERING CO.

CHICAGO 30. ILLINOIS

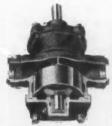
A NAME TO REMEMBER WHEN YOU THINK OF LATHES



UNDERNEATH DRIVE: Completely self contained and enclosed in left compartment of cabinet. For easy, safe belt changing, the lever (indicated by white arrow) is pulled outward to release flat belt tension. Adjustments of both flat belt and V-belt tensions are easy to reach. Multiple V-Belt Drive transmits power from cone pulley to spindle.

BRIEF SPECIFICATIONS: Swing over bed, 10½"... bed length, 43½"... spindle hole, "½½"... precision ground ways: 2 prismatic V-ways: 2 flat ways... 12 spindle speeds, 30 to 1450 r.p.m... worm drive from lead screw spindle for power feeds... friction clutch on power feeds... friction clutch on power feeds... longitudinal feed .0015 to .1000" per spindle revolution ... cross feed .25 times longitudinal feed ... half nut drive from lead screw for thread cutting ... Threads, 48 selections RH or LH. 4 to 224 per inch ... self lubracoting bronze bearings at 40 separate points.





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IN ADDITION TO the Eaton Rotor Pump (shown at left) the Wilcox - Rich Division of Eaton Manufacturing Company produces parts for the complete valve assembly—includ-

ing Zero-Lash Hydraulic Valve Mechanisms, Mechanical Tappets, Self-Locking Screws, Valve Springs, Valve Seat Inserts, and Automotive and Aircraft Valves. Whore than 32 years of valve experience—including pioneer development of the sodium cooled valve and the hydraulic tappet—have earned this company the designation of "Valve Headquarters." In war, as in peace, problems involving the complete valve assembly—from camshaft to combustion chamber—are regularly brought here. Likewise, when at the proper time postwar designs of aircraft, automotive, and stationary engines are undertaken, the engineering facilities of Wilcox-Rich valve specialists will be made freely available.

EATON MANUFACTURING CO.

WILCOX-RICH DIVISION . 9771 French Road, Detroit 14, Michigan

400 an hour!

Producing close tolerance finishes on the inside of engine bearing linings at anywhere near mass production figures was considered an impossibility until broaching was called in. Now, 400 bearings an hour can be made—reducing "breaking-in" periods and eliminating hot spot

replacements.

Because of the unevenness of bearing linings broading engineers figured a maximum and minimum cutting action and devised cutting blades to cover maximum babbit removal. Cutting at 60 feet per minute with a 120 foot return this vertical, 5-ton, 32" stroke Lapointe Sur-

face Broaching Machine produces a finished wall thickness to .0001 tolerance and is one of the fastest cycle time machines on the market. It has a special automatic fixture that makes loading and unloading easy. Each of the cutting blades removes a maximum of .010 each stroke, when maximum stock is to be removed, and are so arranged that regardless of thickness of babbit the bearing comes out completely finished well within tolerance. It operates thus:

1. Work is put in place starting cycle.

2. Fixture moves into cutting position.

Machine slide completes cutting stroke.

4. Fixture returns to out stop.

Main slide returns ready for next cycle.

It's the machine, the broach and the unsung design engineers who made this pertinent contribution to production.



The finished work - com-

Inserting work at start



THERE'LL BE NO STOP FOR THIS PRODUCTION

Burgess-Norton is tooled up now to serve Post-War American Engine Manufacturers in the "Line Production" of the world's finest Piston Pins . . . and for the production of many other hardened and ground screw machine and stamping products.

> Available, too, will be the many Burgess-Norton developments resulting from war production of such products and of tank track links involving the latest technique and equipment in Hydrogen Copper

Brazing . . . a process which, in many instances, will replace welding operations. Burgess-Norton's facilities, "Know-How", Engineering Staff and Metallurgical Labora-

tories will be ready to serve you the day war production requirements permit.

A Part is Never Made Right unless it is Satisfactory to Our Customers

MANUFACTURING COMPANY

40 years in GENEVA, ILLINOIS

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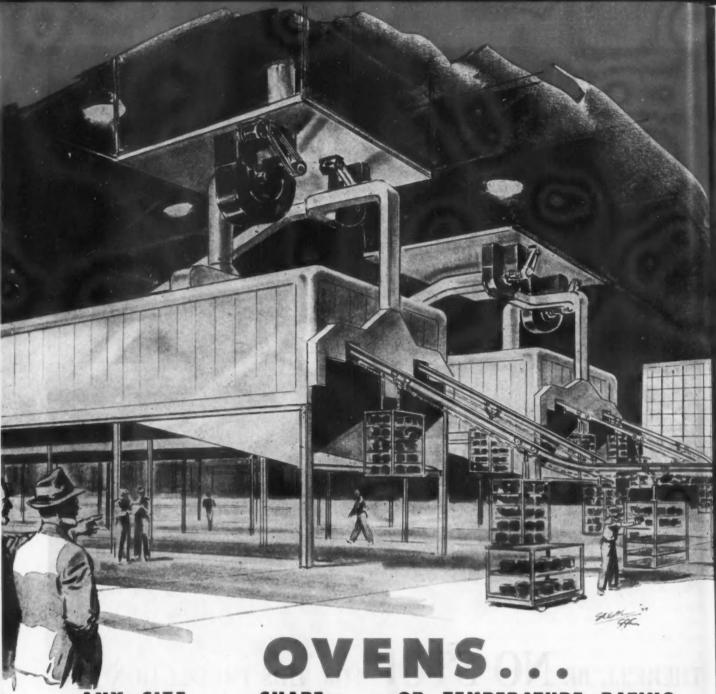
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DESIGNED

Gas or Oil Fired . . . Electric or Steam Heated

Impressive evidence of Mahon ability to produce special-purpose oven equipment is demonstrated by the hundreds of installations now in successful operation. The ovens shown above are typical. During the past two decades, Mahon engineers have encountered and successfully mastered hundreds of complex oven problems. The result is a vast store of valuable data on processes and methods—and many important improvements in oven construction—safety devices—controls—and heating. In every industry where ovens are essential to product finishing, this wealth of information is being utilized to step efficiency up and keep cost of production at the lowest possible level.

Let Mahon experts participate in the solving of your oven problems—whether your need is a single installation or a complete rehabilitation of your oven equipment. It involves no obligation—and you will find the information disclosed by a survey of your plant and product decidedly helpful and

THE R. C.

DETROIT II

CHICAGO 4

Manufacturers of Metal Cleaning Machines • Rust Proofing Machines • Hydro-Filter Spray Booths • Ovens of All Types • Filtered Air Sur ply Units • Hydro-Foam Dust Collectors—and Many Other Units of Special Production Equipment—including Complete Finishing System

JEWELS For Sale

A recent visitor stood wide-eyed amid hundreds of racks of gleaming small tools in our final inspection department. He said, "It is difficult to realize that these thousands of sparkling pieces of metal are tools—they look more like sparkling pieces of m

sparkling pieces of metal sie solutions is a jewel of jewels.

Small wonder he felt that way. For each one is a jewel of precision workmanship, top-notch metallurgy and perfection of finish. That is the way we've made P&W cutting tools of finish. That is the way we've made P&W cutting tools of finish. That is the way we've made P&W cutting tools of finish. That is the way we've made P&W cutting tools of finish. That is the way we've made P&W cutting tools of finish. That is the way we've made P&W cutting tools of finish. That is the way we've made P&W small Tools for their try have come to know and like P&W Small Tools for their try have come to know and like P&W Small Tools for their try have come to know and like P&W small Tools for their try have come to know and like P&W Small

Shown here are P&W Expansion Reamers one of many items in the complete line of Pratt & Whitney quality small tools.

FORCE OFFICER AND AGENCIA - ALEMINGHAM BOSTON CHICAGO GINGINNATI CLEVELAND DETROIT OS ANGELES NEW YORK PHILADELPHIA PITTSBURGH ROCHESTER RAN FRANCISCO ST. LOUIS

PRATT & WHITNEY

Division Niles Bement Pond Company

VEST HARTFORD . CONNECTICUT



Air Sup System





YESTERDAY and TODAY!

Before Pearl Harbor, the leading line of sectional and telescopic antennas used by manufacturers of automobiles, radios and portable radios carried the WARD trademark.

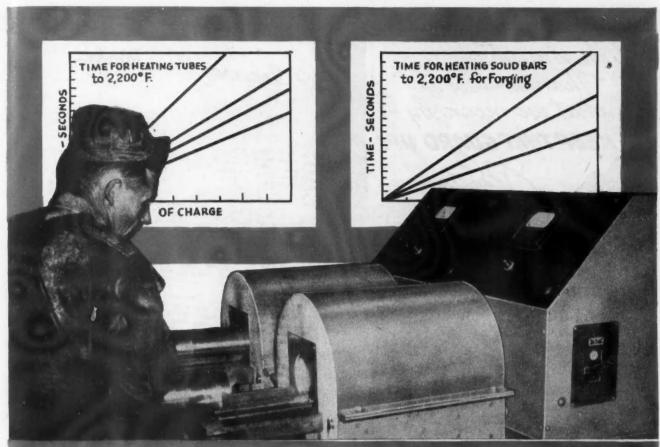
Of course, today, all production is going to further the war effort, and men in tanks, planes, command cars—in communication units of all kinds—are becoming familiar with the name of WARD. It appears on antennas used on communication equipment all over the fighting front.

The expertness of design and manufacture that made WARD the leader in the pre-war period and during wartime, is being supplemented by knowledge gained from the war effort. After the armistice is signed, there will be new and improved products. If the use or specifying of aerials is included in your post-war planning, or if you are a distributor, look to WARD!

UARI

THE WARD PRODUCTS CORPORATION 1523 E. 45TH STREET, CLEVELAND, OHIO





IF YOUR COMPETITOR USES . .

High Frequency Heating!

POST-WAR SUGGESTIONS

With Ajax-Northrup heating equipment you can quickly convert to other heating, brazing, hardening or even melting jobs by inexpensive changes in coils or furnaces. The unit above, for example, can be switched over to peacetime forgings simply by changing the heater coils.

He may be using it to speed his forging and eliminate downtime caused by excessive scale. He may be using it to produce perfect brazed joints with no distortion or residue. Or to improve his product with controlled surface hardening.

If he is, you can't just stand still. You've got to do something to meet today's need for speed and tomorrow's need for more efficient production methods.

If you want to know how you can use high frequency heating and melting to speed up and improve your war operations, and at the same time provide for quick conversion, get in touch with us. Our quarter of a century in induction heating has produced an unparalleled wealth of "know-how."

AJAX-NORTHRUP HIGH-FREQUENCY

AJAX ELECTROTHERMIC CORPORATION · Aigx Park

ASSOCIATE COMPANIES . . . THE AJAX METAL COMPANY. Non-Ferrors legal Metals.

AJAX ELECTRIC FURNACE CORPORATION. Ajax-Wyatt induction Furnaces.

AJAX ELECTRIC COMPANY. INC. Ajax-Hulgron Salt Bath Furnaces.

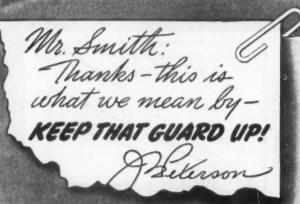
AJAX ENGINEERING CORPORATION. Aluminum Melting Furnaces.



HEATING TRENTON 5, N. J.

MELTING

IES





Mr. G. R. Shields, Asst. Works Manager, General Machinery Corp., Niles Tool Works Division, Hamilton, Ohio.

We thought you would be interested in the performance of the five 36" Miles Time-Saver lathes which are installed here at our Plant No. 2 and have been operating for almost two years. Dear Rex:

It is our firm belief that these five lathes have finished a greater number of tons of ship propulsion sharting in this emergency than any other five lathes in the world during their period of operation, and this statement is undecomparing them with lathes of any size or weight manufactured.

They have finished hundreds of shafts weighing 12,000 pounds each and are now finishing shafts twenty-four hours a day which weigh from 23,000 pounds to 27,000 pounds each, and, homestly, when you see these huge shafts in these little 36" lathes the shafts look bigger than the lathes themselves.

They have been operated continuously twenty-four hours per day and seven days per week without one single replacement of parts, and the total number of shutdown hours for minor adjustments, etc. for the five lathes is 47 hours or an average of 9.4 hours per lathe since the beginning of operations.

If you are interested, with the Mavy's approval we will have some photographs taken and send them to you.

ISMACSON IRON MORES 11 Smith H. W. Smith Vice-President





AL MACHINERY CORPORATIO

HAMILTON, OHIO

THE NILES TOOL WORKS CO.

THE HOOVEN, OWENS, RENTSCHLER CO.

GENERAL MACHINERY ORDNANCE CORPORATION



... IF YOU ARE INTERESTED IN SEAMLESS AND DROP FORGED STEEL PRODUCTS

Anticipating every practical calculation or analysis that may confront you, the buyer of Seamless and Drop Forged Steel Products, The Harrisburg Steel Corporation has compiled this Catalog to serve with the same efficiency and accuracy that you have found in all Harrisburg Products.

Indexed, glossarized and departmental-

ized, it is a veritable textbook for expert or apprentice. Tables of authentic S. A. E. specifications covering every product we make in whatever grade or quality you may need.

A quick-reference dictionary of our products, their ingredients and uses completes this handbook, which gives accurately illustrated descriptions of Harrisburg Products.

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HARRIS	BURG Seamless	STEEL PRODUC	T 5

CENTRAL UNIVERSAL HOSE CLAMPS IN





Central Universal Hose Clamps are used in the production and servicing of Army and Navy trucks, jeeps, half-tracks, amphibians, cranes, bull-dozers, etc.; also as original and replacement equipment on road-rollers, farm machinery, portable saws, searchlights, marine, diesel and gaseline engines, and for all types of radiator hose.

SEND FOR FREE SAMPLE OF CENTRAL UNIVERSAL CLAMPS

THE Half Track DEPENDS ON CENTRAL CLAMP-POWER

Central Universal Hose Clamps are an important part of America's global war machine. Standard equipment for Army and Navy combat vehicles, they are supplying vital clamp-power with unfailing dependability.

These Clamps are strong enough for every production and service requirement. They are precision built of rustproof, extra heavy rolled steel . . . self-locking . . . cannot strip or loosen . . . able to withstand abnormal pressure, stress, strain and vibration. They also are easier to use in hard-to-get-at places, and can be attached or removed without disconnecting the line.

Furnished flat, one length will fit hundreds of diameter sizes — because Central Universal Hose Clamps are 100% universal!

CENTRAL EQUIPMENT CO.

900 SO. WABASH AVE. CHICAGO 5. ILL.



PUTTING THE ATH DIMENSION

The 4th dimension is TIME. It can be measured just as accurately as length, breadth, diameter or thickness. And it is just as important an element in the cost of anything that is made—for Time is money.

In manufacturing practice today, Time is the ONE cost factor that is within the control of the individual manufacturer.

Wages and material costs are likely to be subject to industry-wide or even nation-wide controls and practices.

But what the individual worker does with his hours, minutes and seconds depends largely on the technique he follows and the tools he has to work with.

Acme-Gridley Automatics—Bar and Chucking—help to control, and to reduce, the size of the 4th dimension. They guarantee to produce *more* in a given time.

Result—they are the great cost-reducers.

National Acme offers to owners of automatic machines a new service—the retooling or reconditioning of Acme-Gridley Automatics—in the plant where they were built, and by the men who built them. This service is not too costly. It guarantees you the exact original production capacity of a new machine of the same model.

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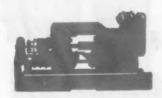
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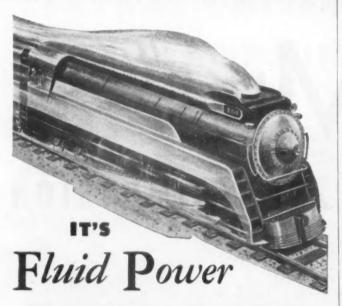
If you have automatics that will need retooling or reconditioning, write us about them.



ACME-GRIDLEY AUTOMATICS maintain accuracy at the highest spindle speeds and fastest feeds modern cutting tools can withstand.

The NATIONAL ACME Company

INDUSTRY'S NEW SOURCE OF CONTROLLED POWER



THAT OPERATES A TRAIN

On railroads Fluid Power is used for everything from blowing the whistle to stopping the train. And it is only with Fluid Power that all brakes can be controlled from the cab.

Fluid Power is transmitted through tubes. Brake pressure is delivered to every car without shafts, gears, belts or pulleys.

This method of providing force where it is needed has many advantages. With Fluid Power you can move tons or squash a bug on a watch crystal!

Fluid Power is easy to control. Parker Engineered Systems are performing a host of different tasks in a wide variety of industries. Applications of Fluid Power seem almost limitless.

If you need power for drive or control, it will pay you to investigate the advantages of Fluid Power. It may hold your answer to better postwar products. A Parker Engineer will be glad to give you complete details.

INVESTIGATE FLUID POWER

Parker has engineered Fluid Power Systems for the chemical, marine, aircraft, petroleum, machine tool and other industries. New uses are constantly being developed. A Parker Engineer will know how Fluid Power can serve you. Ask him. Or address The Parker Appliance Company, 17325 Euclid Avenue, Cleveland 12, Ohio.

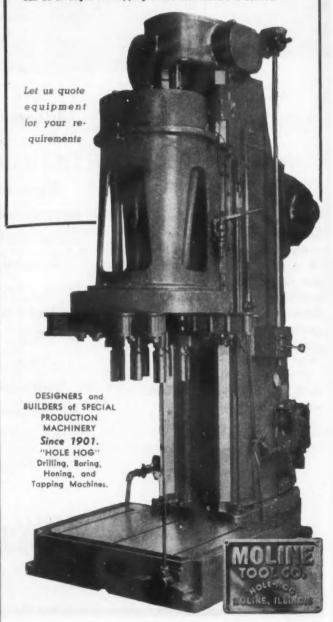
PARKER

Costs are reduced by High Production DRILLING

The Moline No. 115-U Hydraulic, Rall-Feed Driller is a rugged, easy-to-operate, heavy duty production tool. The rated capacity of this machine is sixteen $\frac{9}{2}$ -inch holes in steel or sixteen $\frac{11}{2}$ -inch holes in cast Iron.

The No. 115-U as regularly furnished has 16 spindle drivers built into the spindle head gear housing, although a greater or lesser number can be furnished if desired. Four speeds to all spindle drivers are instantly available through a gear shift lever, and superimposed on these four speeds is provision for individual adjustment of each spindle driver to either of two speeds or neutral. Each drill spindle is driven by a driver through two heavy universal joints and an extra long seamless steel driving tube which permits maximum adjustment of spindles with a minimum angular displacement and results in longer life of the universal joints. The drilling area covered by adjustment of the spindles as regularly furnished is 18-inch by 36-inch rectangular or 20-inch circular as desired. Other sizes can be supplied.

An automatic operating cycle minimizes fatigue of the machine operator and consists of rapid advance to the work, proper feed, dwell if necessary and rapid return. This type of machine can be arranged for tapping where that feature is desired.



AIRCO AIRCO

... FOR PRODUCTION,
MAINTENANCE AND RESEARCH

AIRCO gases, produced by modern scientific methods to the strictest standards of purity and uniformity, are supplied to industry through nation-wide Airco distributing points. These gases are available in volumes to meet every requirement... in standard commercial size cylinders and in trailers with capacities up to 40,000 cu. ft. Thus Airco gases are quickly delivered to shops and plants throughout the country in whatever size containers are most suitable for the customers' needs. In that way, individual requirements for 200, 20,000, or several million cubic feet, monthly, are met.

To assist manufacturers in using these Airco gases most effectively, Air Reduction provides "on-the-job" technical assistance through its Applied Engineering Field Service Department. For further information on Airco gases—as well as Airco's complete line of apparatus and supplies for every oxyacetylene flame application and arc welding need—call or write the

nearest Airco office, or, if you prefer, communicate direct with the New York Office, Department AA.

OXYGEN guaranteed 99.5% pure...assures maximum speed and economy in cutting, and greater efficiency in welding.

ACETYLENE proved by use and test to be the most economical fuel gas for oxyacetylene welding and other flame applications.

NITROGEN dry and inert, contains less than 0.3% oxygen. Also available at higher purity to meet specialized needs.

HYDROGEN produced electrolytically, contains less than 0.5% oxygen.

ARGON manufactured pure or mixed with nitrogen as specified by user.

HELIUM is available with a purity of approximately 98% and higher.

* BUY UNITED STATES WAR BONDS *



AIR REDUCTION

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Aided Production Problem in Aircraft Industry

With the production of aircraft speeding toward the 6,000-a-month goal, many technical problems faced Industry. One was the deep-drawing of aluminum alloy (61-S) for the housing or "dome" of hydromatic propellers. In the plant of the Worcester Pressed Steel Company; this problem was solved with the use of the Watson-Stillman 1500-ton metal forming press. During the past three years more than three million pounds of sheet aluminum have been fabricated at this plant. The complete line of Watson-Stillman Hydraulic Presses is illustrated and described in Bulletin 110-A. Copies are available on request. The Watson-Stillman Co., Roselle, N. J.





"BATTLE-SCARRED" WAR MACHINES need the plasma of proper lubrication

DIAGNOSIS

During the hectic 24-hour days of war production, machines grew old before their day. One of the greatest factors in prolonging their lives is the injection of modern "fortified" lubricants. The first step is a diagnosis of the job—a study of your plant's lubrication needs—to reduce varieties, to standardize lubrication procedure and control. Houghton engineers, upon request, will make such a study and build a simplified lubrication plan for your consideration.

R

Given the plan, the second step is to prescribe the highest grade lubricants, fortified by science to provide such qualities as leak resistance, high film strength and oxidation stability. Houghton supplies such specially treated oils and greases in volume. Write for the abbreviated booklet on "Fortified Lubricants" and for details of the Simplified Lubrication Plan which is helping so many plant maintenance men these days.

E. F. HOUGHTON & CO.

303 W. Lehigh Ave., Philadelphia 33 Chicago—Detroit—Cleveland—San Francisco

FIRST AID FOR OVER-WORKED MACHINES: High-film-strength, polymerized Sta-Put Lubricants * Dynamo-Turbine-Compressor D. L. Absorbed Oils * Fortified-film "High-V.I." Hydraulic Oils * Reversible, stable "Absorbed Oils" for Ball and Roller Bearings * E. P. Spindle Oils, Gear Oils, and a host of other fortified lubricants built for war plant duty.



.... for perfect make-and-break!

Maximum service life, negligible maintenance, perfect performance-that's the record of **METROLOY Tungsten Contacts in vital industrial** applications throughout the world.

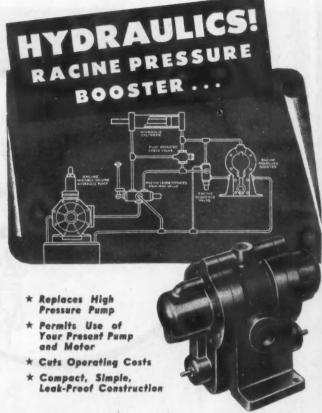
Tungsten's non-filming and non-oxidizing characteristics practically eliminate contact resistance - even under the most adverse conditions. A perfect contact is assured at all times.

These advantages, together with the skill and experience of METROLOY engineers and craftsmen, result in contacts of outstanding merit.

Complete collaboration is offered by the METROLOY Engineering Department for solution of contact problems. Write today for complete information. Metroloy Company, 55 E. Alpine St. Newark 5, New Jersey.



NEAREST TO RESISTANCE-FREE OPERATION





A Racine Hydraulic Pressure Booster will give your oil hydraulic circuits greater flexibility. Now you can get 50 to 3000 pounds pressure from your present low pressure con-stant or variable volume hydraulic pump. Use lower horsepower motor and low pressure control valves.

Exclusive and patented by Racine, this Hydraulic Pressure Booster is free from repairs

—no driving mechanism to wear out. Requires a minimum of space. Booster is 101/8" high, 81/8" wide, 18" long.

Racine Offers a Complete Hydraulic Service

Include in your hydraulic circuits Racine Oil Hydraulic "Vane Type—Variable Volume" Pumps. Capacities 12-20-30 G. P. M. Operating pressures 50 to 1000 lbs. P. S. I. Also Racine "Sleeve Type—Balanced Piston" Valves. Sizes 3/8 "to 11/2". Racine hydraulic engineers will be glad to help you with your hydraulic applications. Write for complete Catalog No. P-10-C. Address Dept. AA-P.

RACINE HYDRAULIC METAL CUTTING MACHINES . The Production Saws of Modern Industry

A full line of Metal Saws including models with Racine Automatic Stock Feed. Racine Saws feature the latest improvements and devices for accurate, high speed cutting of all metals. Blade life is increased because of Racine's Hydraulic Con-trol of feed and pressure. They can be regulated to cut any metal at the right speed regardless of density, shape or structure.

For a metal saw of modern design and high efficiency—one that will pay for itself by the savings it

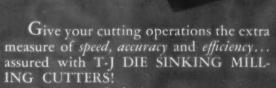
makes, a Racine is your best bet. Available are a wide variety of models in all price ranges. Capacities 6" x 6" to 20" x 20". Write for Catalog No. 12. No obligation.





GEAR YOUR CUTTING

BETWEEN GRINDS



Shop men find they get more work between grinds with T-J Cutters. Designed

and built right for sturdiness...ability to hold a sharp edge longer...and carry less breakage percentage. Made from a standard, extremely high grade steel ... assuring extra strength, wear resistance and uniformity. Backed by long years of T-J Leadership in building better cutters! Write for catalog.

The Tomkins-Johnson Co., Jackson, Mich.

FOR TOUGH JOBS SPECIFY T.J

TOMKINS-JOHNSON

DIE SINKING MILLING CUTTERS

IES



Making CLOTH serve more ways

CURRENT HOLLISTON PRODUCTION

includes COATED and IMPREGNATED FABRICS. INSULATING NATED FABRICS. SEPARATOR CLOTH BASE SEPARATOR CLOTHS TRACING AND BLUE PRINT CLOTHS White and blue, ink or pencil. MAP waterproof to take any ink, meet waterproof to take any ink, meet waterproof to take any ink, meet waterproof, shall be consider CLOTH; waterproof, opaque, pregnated waterproof, opaque, translucent on light proof.

translucent or light proof.

We urge you to consider CLOTH;

and invite you to consult with us concerning possibilities and developments for your specific requirements.

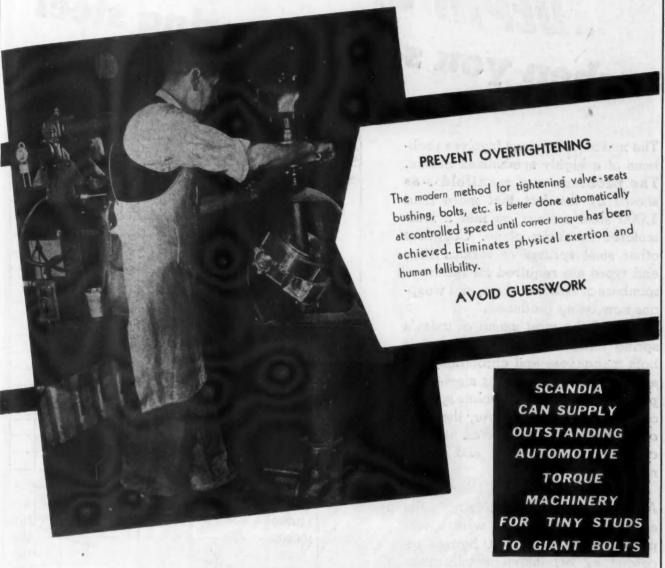
Cloth as woven, is a structural base in or upon which may be built many colorings, finishes and coatings.

Cloth is flexible, has high tensile strength and is very durable. By special processing, cloth serves many purposes. Combining cloth with plastic types of fillings and coatings opens up many new industrial use possibilities.

Our business is specialty finishing of cloth to special needs. Our research department is devoted to perfecting and developing these processes.



Correct Torque \ \begin{array}{l} for DRIVING \ BUSHING-THREAD VALVE-SEATS \ with Scandia Torque-Machines: \end{array}



The vital necessity of WAR demanding accurate, gas-tight fittings in the power-plants of famous aircraft; the willingness of plant engineers to benefit by new developments paved the way for Scandia Torque Machines production results make those machines a "must" in modern plants. Write for information NOW!

* Manufactured under Bronander Patents

Scandia Manufacturing co.

NORTH ARLINGTON

NEW JERSEY

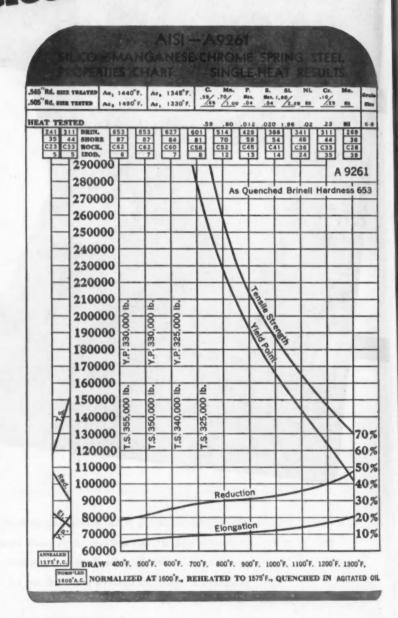
STRENGTH...TOUGHNESS Look for DEPTH OF HARDNESS when you select a spring steel

The making of springs involves problems of a highly specialized nature. The problems are manifold - as shown by the fact that more than 1,000 steel springs go into a fourmotored bombing plane. Countless other steel springs of various sizes and types are required for the huge numbers of vehicles, ships, and weapons now being produced.

One of the most useful of today's spring steels is A 9261. Containing both manganese and chromium, it is a deep-hardening spring steel-one particularly suitable for volute springs of large section. Moreover, the high content of silicon assures an unusual combination of strength and toughness.

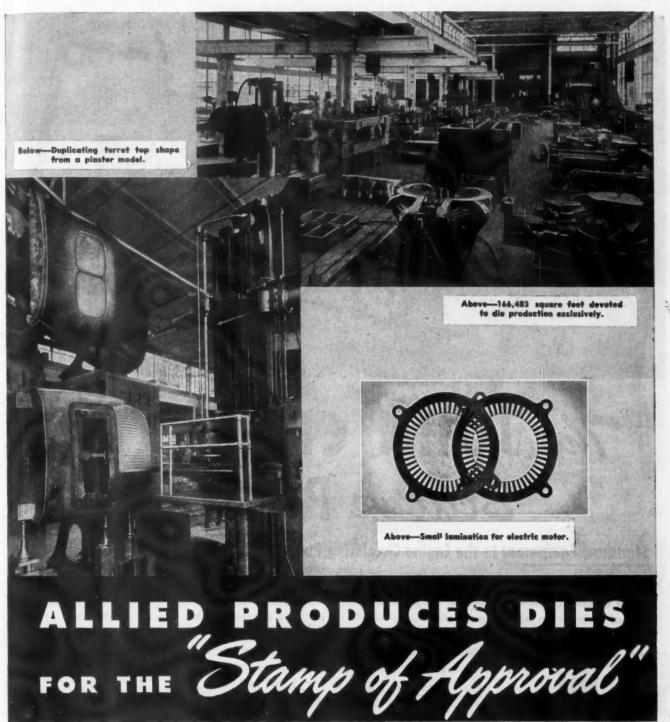
The superior tensile strength of A 9261 is shown graphically in the accompanying chart, which was plotted from actual test figures recorded by Bethlehem metallurgists. Note how impressive the tensile figures remain even at relatively high drawing temperatures.

A tremendous amount of research on wartime steels has been done by Bethlehem metallurgists - research that has included the most exhaustive laboratory tests. If you have a problem involving analyses, properties, heat treating, or applications, write Bethlehem Steel Company, Bethlehem, Pa.





BETHLEHEM ALLOY STEELS



Buy More War Bonds

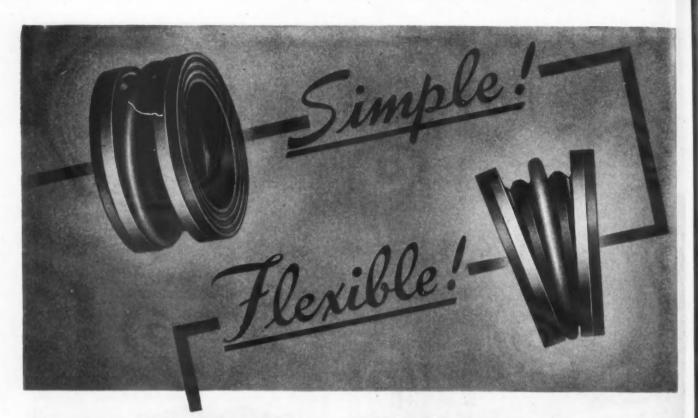
Long before the war, precision dies produced by Allied Products Corporation enjoyed the automotive industry's "stamp of approval." Today, Allied is engaged 100% in the production of dies and parts for manufacturers of war materiel. But the moment the shooting stopsor before, if the war production board desires-Allied will be ready to start producing again for the makers of cars and trucks and their suppliers,

Dies of all types and sizes up to the largest, including those where extreme accuracy is required, are an Alfied specialty. Modern equipment from Swiss Jig Borers to a 23-foot Ingersoll Milling Machine, speeds the operations of experienced craftsmen. Additional equipment, including electric cranes with a handling capacity of 50 tons, expedites the flow of finished dies and parts. Bring your stamping die problems to Allied for sure solution!

"IT'S AN ALLIED PRODUCT!"... Allied Products Corporation and its divisions, Richard Brothers and Victor-Peninsular, in Detroit and Hillsdale, Michigan, also make: The original, patented R-B Interchangeable Punch and Die; plastic molds; jigs and fixtures; precision hardened and ground parts; and other special products.

Executive Offices: 4646 Lawton Ave., Detroit 8, Mich. All four plants have now added a star to their Army-Navy "E" pennants

IES



7he JOHN CRANE Bellows PUMP SEAL

Standard Equipment in the Engine Circulating Pumps of Jeeps—Tanks—Trucks—Aircraft

Simple Design for easy installation on the production line or in replacement—Flexibility to compensate for normal variations in machining the seal cavity—and Perfect Sealing Performance—three basic reasons why millions of John Crane Bellows Seals are in

use today.

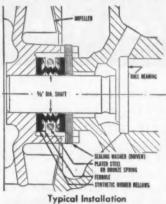
Seal and Washer in Operating
Position (Under Load)

Quick Installation is assured. Just slip the Bellows Seal into position, either end first (the two ends are identical). It seals on the end flanges, not on the shaft, and slides on freely. Then slip a Sealing Washer into place to complete the installation.

The Bellows Unit and Sealing Washer rotate with the impeller; there is no wear on the bellows assembly. The helical spring and synthetic rubber bellows are flexible, and adjust automatically to maintain an effective seal.

Available in sizes for 5/16" to 11/4" shafts.

Send for illustrated Bellows Seal Bulletin. Our Engineering Department will be glad to work with you in making proper application to your pumps.



CRANE PACKING COMPANY

BALTIMORE, BOSTON, BUFFALO, CLEVELAND, DALLAS, DETROIT, HOUSTON, LOS ANGELES, NEW ORLEANS, NEW YORK, PHILADELPHIA, PITTSBURGH, SAN FRANCISCO, ST. LOUIS, TULSA

1818 CUYLER AVE. . CHICAGO 13, ILL.

CRANE PACKING CO., LTD., Hamilton, Ontario, Canada Branches: Montreal, Toronto, Vancouver

Up where sawmills have to be flown in... Bowser Engineered Fueling Systems



Installing airports and fueling systems on the route to Alaska operated by Northwest Airlines for the Army Air Forces, was a mighty tough job. The route was largely through primitive country, some of it so isolated that ground transportation methods were useless. For instance, a 24-bed hospital was flown in. So was a sawmill. That gives you an idea of the problems.

Bowser Aviation Fueling Systems were chosen for three major reasons...

 In airport operations in many countries, working under all extremes of conditions, Bowser Systems have proved superior in the delivery of clean, dry, safe fuel.

- 2. Bowser designs and builds systems to meet virtually every kind of special requirement, however unusual.
- 3. Bowser-built equipment has established records for dependability and efficiency in hundreds of industries over scores of years.

Airport fueling systems are a specialized field, of course. But Bowser specializes in every phase of exact liquid control. Bowser Meters, Proportioners, Filters, Lubrication Systems, Pumps, Stills, etc., have indispensable appli-

cations in almost every factory.

Here's a typical example: A plant in upper New York State installed a Bowser Pressure Filter for cutting oil. First job was reclaiming oil that had been in use five years and was terribly dirty. Two processings restored it to original color.

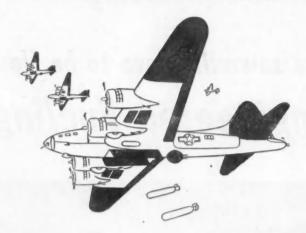
Cutter life between grinds was increased approximately 100%. Note this, too—Dermatitis cases (skin infection, due to contact with oil) dropped appreciably immediately after the filter went to work. Those points add up to a major economy. Bowser, INC., Fort Wayne 5, Ind.



Not only has Bowser's war production earned the Army-Navy E... Bowser equipment has helped earn it for scores of other companies.



The Name That Means EXACT CONTROL of Liquids



BRIGGS REPORTS

on One Billion Dollars in War Orders

-and how the money is being spent

During peacetime, Briggs Manufacturing Company is the Nation's largest independent automobile body manufacturer. In the war Briggs is devoting its peacetime skill to making bodies and parts for medium tanks and aircraft; also, bomber turrets, droppable gas tanks and non-ferrous castings.

Briggs war orders total approximately \$1,000,000,000. This money has been spent or is being spent as indicated in the box shown herewith. Percentages are based on distribution of Briggs 1943 sales dollar.

In 1943 Briggs did twice as large a dollar volume of business as it did in an average peacetime year. In 1943 Briggs delivered double the number of tank hulls delivered in 1942. In the same year Briggs delivered to the U. S. Army and Navy

1942. In the same year Briggs delivered to the U. S. Army and Navy more than 22,500,000 pounds of airplane sections, as compared with 7,000,000 the year before. This included almost twice as many bomber fire-power turrets as in the previous year. Total shipments to date of airplane sections by Briggs exceed 45,000,000 pounds.

Earnings by Briggs hourly paid employees in 1943 averaged \$3,159.00. On December 31, 1943 there were 39,312 people on the Briggs payroll, of which 21,737 were men and 17,575 women. This is 48% greater than on December 31, 1942 when Briggs payroll was 26,401 people. In the first five months of 1944, shipments of airframe

53.6% to about 40,000 employees for wages and salaries.

0.2% for executive salaries.

32.1% to some 2,000 subcontractors for materials, supplies and assemblies.

1.9% to stockholders for dividends.

9.2% for taxes.

1.2% for depreciation.

1.2% for reconversion expenses and other costs arising from the war.

0.6% left in the business.

sections, by Briggs, were at considerably greater monthly rates than during any other months since the war began. Production of tank hulls was almost equal to the 1943 rate. Deliveries of auxiliary gas tanks, for the first five months of this year, were 7 times the total for 1943, and shipments of aircraft fire-power turrets were at a rate almost twice that of last year.

Unless very extraordinary developments take place, Briggs 1944 war business should be equal to, or exceed, its record 1943 year.

During the war, Briggs has shown that experience in manufacturing good automobile bodies, plumbing ware and non-ferrous castings has enabled it to turn out good "bodies for bombers, fighters, tanks" and

other war requirements. Briggs is glad that it has been able to play an important part in the Nation's war effort. All of its facilities and energies will continue to be available to the Armed Forces until Victory has been won.

However, when Victory does come, Briggs is prepared to go about the job of reconversion with the same dispatch and intensity that it applied to the preparation for war, and, if it is allowed to do so, can go back into at least some peacetime production quickly.

W. O. BRIGGS Chairman of the Board W. P. BROWN



BRIGGS MANUFACTURING COMPANY

DETROIT





meet Mr. Ooey



Mr. Ovey's one of a large family of Eagle Brand Cement adhesives we sell for bonding Felters Felt to other materials where flexibility, strength and resistance to aging are important factors. He may be just the man you need for fastening Unisorb felt pads to machine bases to dampen vibration . . . smother noise.



Brother "Herc" is a Herculean for keeping a strong bond between Felters felt and asbestos board, wood, concrete, rough metals, primed Aluminum Alloys, and a variety of other materials and surfaces.



Joe, the black sheep of the family, has kicked around lab benches and bottles until he's developed a toughness that oil, grease, water, floor washing compounds, and high and low temperatures can't weaken—once he comes to grips with Felters Felt.



And Willie takes orders for Eagle Brand Cement stocked in our sales offices in quart or gallon containers. So whether you use Felters Felt for acoustical or thermal insulation in aircraft... or cut parts for gaskets or piano hammers, you get the correct cement for the job. For the full story of Mr. Ooey and his brothers' abilities, write for copy of "Adhesives for Felt."

THE Felters Company

Offices: New York, Philadelphia, Chicago, Detroit . Sales Representatives: Dallas, Los Angeles, Hashville, St. Louis, St. Paul . Mills: Johnson City, New York: Millbury, Massachusutts; Jackson, Michigan



quality and quantity

METAL STAMPINGS





Whether the quantity is large or small, Metal Specialty assures you quality stampings. The Metal Specialty Co. is also completely equipped to give you efficient service in Rolling. Coining. Forming. Drawing and Annealing in all Metals. Specialists in Hydraulic cold drawing and embossing in all metals including stainless steel. Deep drawing and embossing up to 850 tons capacity. Shells-drawn up to 20" in depth. Assembling including Flash and Resistance Seam Welding. Pressed metal products to specification.

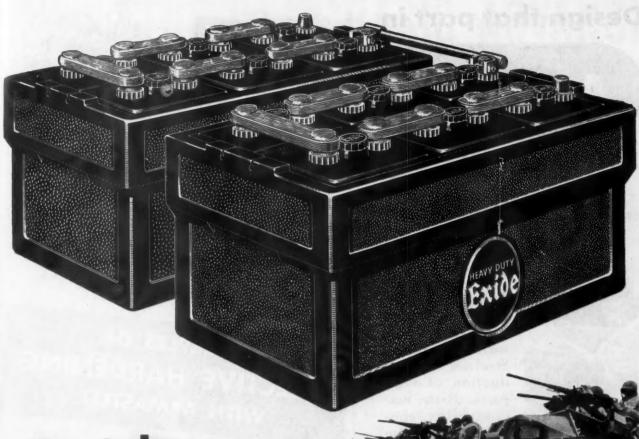




The METAL SPECIALTY Co.

MAIN OFFICE AND PLANT . ESTE AVENUE . CINCINNATI, OHIO





Exides

provide the "Go" in the Water Buffalo

The material and equipment put into the mechanized Water Buffalo must be rugged and dependable. This is one piece of "Off-the-highway" equipment that cannot fail. When charging a beachhead-failure means death.

We at Exide are proud to have contributed a battery that fills this role of dependability and durability. Backed by many years of field research and experience, the Exide Heavy-Duty Battery has been specifically designed to give peak performance under all conditions.

Write today for a FREE copy of the Exide Catalog on Heavy-Duty Batteries. Here is accurate, clear, concise information on Exide Batteries for cranking Diesel Engines.





THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32

Exide Batteries of Canada, Limited, Toronto

Design that part in



and cut production time –lower costs



In recent years, scores of manufacturers have turned to Arma-Steel for the production of vital parts. Better machinability, cou-

pled with a substantial reduction in the amount of metal to be removed, has saved precious time, extended tool life, boosted output.

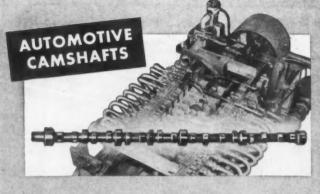
These machining advantages are fundamental; but they do not tell the whole story. Manufacturers have proved ArmaSteel to be an exceptionally versatile material, adaptable to varied requirements and lending itself to time-saving techniques. Particularly outstanding are the results obtained with ArmaSteel by selective hardening.

*Reg. U. S. Pat. Off.

SAGINAW MALLEABLE IRON DIVISION OF GENERAL MOTORS

Saginaw, Michigan

BUY U. S. WAR BONDS— Fighting Dollars To Back Fighting Men



In a specially designed hardening machine, all cams and eccentrics of this ArmaSteel camshaft are flame-hardened simultaneously with natural gas, and then quenched in oil to a hardness of 50 Rockwell C minimum. Hardening time is 30 to 40 seconds for each camshaft; depth of hardening is ½" on nose of cams, and ½" for 120° on each side of nose.

Another manufacturer obtains equally satisfactory results by induction hardening and quenching in water.

EXAMPLES OF SELECTIVE HARDENING WITH ARMASTEEL

SHIFTER SHOES for Automotive Transmission

The bottom of the slot of this part is oxyacetylene-hardened and water-quenched. 50 Rockwell C minimum hardness is consistently obtained.



BREECH LOCK CAMS



Previous methods of producing this breech lock cam for .50-caliber machine guns required a hardened steel insert in the ramp. With Arma-Steel, the need for this insert was eliminated. Satisfactory results are obtained by flame-hardening the ramp to 50 Rockwell C minimum.



The tips of these ArmaSteel rocker arms are heated in a lead bath at 1600°-1625° F. for one to five minutes, then quenched in oil. As in the other methods shown here, this results in a hardness of 50 Rockwell C minimum.

CAST FOR A LEADING ROLE IN INDUSTRY

THE ONLY BASIC ADVANCE IN TIRE VALVE DESIGN IN MORE THAN 40 YEARS!

Jenkins Capless Tire Valve offers features found in no other valve
... features that spell longer tire life and easier tube sales

More than 40 years have passed since the first practical pneumatic tire valve was invented. During that long period, tires and tubes have been radically improved in many ways. But there has been only *one* really basic advance in tire valve design... Jenkins Capless Tire Valve.

New and different in the way it's made, the Jenkins Capless Tire Valve is equally modern in the way it works. It is the only valve that needs no cap to positively maintain proper air pressure and thus save precious tires. It is the only valve that's made in one simple unit to save valuable servicing time and trouble. These statements are not

claims, but facts - proved by hundreds of millions of miles of road service on millions of Jenkins valve equipped tubes!

Tube manufacturers and service men who are no longer satisfied with tire valves invented when the automobile was in its infancy, will be interested in knowing why the Jenkins Capless Tire Valve is unique – and why this modern valve will improve the products they make or sell. The pictures below show some of the main reasons . . . and a letter to Jenkins Bros., Rubber Division, 80 White St., New York, 13, will bring you the complete story.



CENKIKES

THE ONLY VALVE that does not depend on a detachable cap to help seal in air and maintain pressure. The Jenkins Valve has no cap-it needs none!



THE ONLY VALVE that has no separate core to work loose and let air escape. Its core is an integral part of the valve, requiring no troublesome servicing.



THE ONLY VALVE with a plug-type seat . . . a design long recognized by valve engineers as one of the swest methods of maintaining a clean, leak-proof seal.



THE ONLY VALVE with no threaded metal tip. Screw-on fittings can always be tightly screwed over tip of Jenkins Tire Valve, without danger of damage to valve.





THE ONLY VALVE that's truly flexible. Has no long, rubber coated metal shank to rip tube in case of a flat. The tough, flexible stem readily recedes through rim hole.

JENKINS Caples TIRE VALVE SEALS AIR IN + SEALS DIRT OUT MAKERS OF FAMOUS JENKINS VALVES

RIES

UDYLITE NEWS



The new, Udylite full automatic plating machine.

Udylite's engineers really "hit the jack pot" when they did this job.

It's a compact, multi-purpose piece of equipment—small enough to move easily wherever needed—so low in cost that everyone can have one or a half dozen as needed.

NOW, you really can't affor NOT to own a full automatic.

This new machine has more unusual features than we can tell you about here, yet basically it is built on time-tested principles using the best features of some of Udylite's finest existing equipment.

It's self contained, shipped assembled, in one freight car, ready to set on your floor.

Write for our detailed bulletin on this machine. We'll gladly answer your questions.

THE UDYLITE CORP.

1651 E. Grand Blvd., Detroit 11, Mich. Long Island City, N.Y.

Cleveland

Chicago



There is no landing field in Cloudland,... no place on star or neighboring planet where a bearing might be replaced.

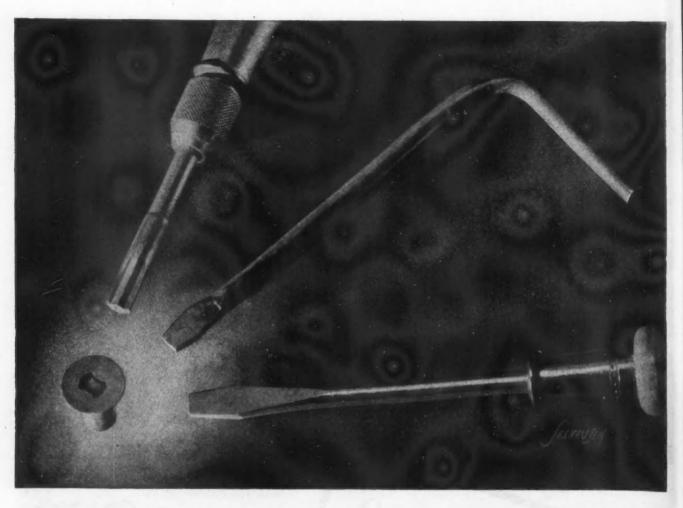
So for safety, dependability and performance, airplane manufacturers, engine builders and ground crews almost without exception equip with Signature... the bearings that helped Southwest to establish a record

of 1,000,000 military pilot training hours flown.

It is only natural, then, that Harry Barnes, superintendent of the Overhaul Depot engine department of Southwest Airways, Inc., is high in his praise of BESF Bearings and the effective, efficient performance they have given under rugged training program conditions.

SKF INDUSTRIES, INC. . FRONT ST. & ERIE AVE. . PHILADELPHIA 34, PA.

RIES



With Clutch Head-Either Will Do

This is the only modern Assembly Line screw so designed that it also operates with an ordinary type screwdriver... even with a piece of flattened steel rod in emergency. The only requirement is that the screwdriver or flattened rod be reasonably accurate in width. The thickness of the blade, so important with other screws, is a secondary consideration with CLUTCH HEAD because its roomy recess allows great latitude in this respect. Obviously, a broad tolerance like this is invaluable in field service where the Type "A" Drivers (used for the fast tempo of Assembly Line work) may not be immediately available. This logical simplified design applies to all sizes and styles of CLUTCH HEAD Screws... an exclusive feature that is daily proving its worth in the War effort by keeping men and machines in motion when time is vital.

Personally test this feature...and the many other exclusive CLUTCH HEAD advantages for faster, safer, and lower-cost production. Ask us to mail you package assortment of CLUTCH HEAD Screws and sample of the Type "A" Bit. You will find that CLUTCH HEAD is The Screw That Sells Itself.

You may order CLUTCH HEAD Screwsin Standard and Threadforming types for every purpose. Their production is backed by the resources of this Corporation and by those of responsible Licensees.



This rugged Type "A" Bit is an important lower-cost item. It delivers longer uninterrupted service and a 60second application of the end surface to a grinding wheel restores its original efficiency.



UNITED SCREW AND BOLT CORPORATION
CHICAGO CLEVELAND NEW YORK

SOUTH BEND LATHES

GIVE SKILLED MANPOWER MORE PRODUCING POWER

To give our fighting forces the increased striking power of more and better weapons, Industry's skilled manpower must have the increased producing power of fast, accurate tools.

South Bend Lathes squarely meet this requirement. Their rigidity and wide range of spindle speeds permit taking full advantage of the higher cutting speeds that are possible with carbide and diamond tipped tools. Their precision makes it possible to finish turn and bore with such accuracy that subsequent grinding and honing operations can often be eliminated.

South Bend Engine Lathes and Toolroom Lathes are made in five sizes—9" to 16" swings. The Turret Lathes are made in two sizes—Series 900 and Series 1000. Write for a catalog.

WAR



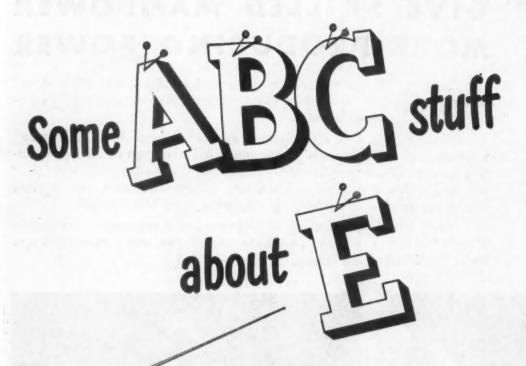
July 1, 1944

RIES

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

BEND 22. INDIANA

149





IS A VERY important letter in this war.

It's the name of the War Bonds you buy-"War Savings Bond Series E."

As you know, a Series E Bond will work for you for ten full years, piling up interest all that time, till finally you'll get four dollars back for every three you put up. Pretty nice.



The first job of the money you put into "E" is, of course, to help finance the war. But it also gives you a wonderful way to save money.

And when the war is over, that money you now put away can do another job, can help America swing over from war to peace.



There'll come a day when you'll bless these Bonds—when they may help you over a tough spot.

That's why you should make up your mind to hang on to every Bond you buy. You can, of course, cash in your Bonds any time after you've held them for 60 days. You get all your money back, and, after one year, all your money plus interest.

But when you cash in a Bond, you end its life before its full job is done. You don't give it its chance to help you and



the country in the years that lie ahead. You kill off its \$4-for-every-\$3 earning power.

All of which it's good to remember when you might be tempted to cash in some of your War Bonds. They are yours, to do what you want with.



But . . . it's ABC sense that . . .

They'll do the best job for you and for America if you let them reach the full flower of maturity!

WAR BONDS to Have and to Hold

The Treasury Department acknowledges with appreciation the publication of this message

SOLVE YOUR
REMOTE CONTROL
problems

with Sperry's line of

HYDRAULIC REMOTE CONTROLS

featuring the famous EXACTOR --

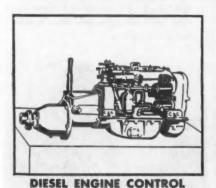
Sperry's EXACTOR HYDRAULIC CONTROL by means of a flexible, unique, single-tube system, has solved hundreds of remote control problems for design engineers in many industries.

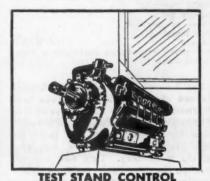
With over 60,000 units now installed on marine, aviation and general industrial equipment geared to war's demands for dependable, maintenance-tree operation, the EXACTOR HYDRAULIC CONTROL is saving thousands of dollars and hundreds of engineering hours for many of America's top-notch designers in these fields.

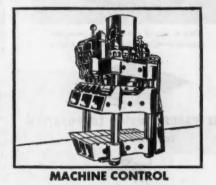
Accurate and self-contained, requiring no special engineering to install and maintain, the EXACTOR HYDRAULIC CONTROL is well worth investigating if you have a control problem involving the accurate transmission of applied motion over distances up to 200 feet.

Sperry's EXACTOR HYDRAULIC CONTROL is rated at 125 inchpounds torque in either direction or as high as 400 inch-pounds in one direction.

WRITE FOR DESCRIPTIVE BULLETIN 78-1







You

and

ning

mber

ours,

d for full

TRIES

PRECISION PARTS

GRINDING OUT MESSAGES FOR G. H. Q.



... mass-production with accuracy . . .

Teletype, that miraculous contrivance that writes out a message hundreds of miles away as fast as the sender can type at the other end, plays a leading role in vital operations. These little pieces, ground to close tolerances by Ace, are an important part of the teletype machine.

From rough-machined and hardened blanks, Ace grinds and hones the inside diameter. Then, locating from this diameter, they cylindrical grind the two outside diameters and faces, holding the shoulder lengths. Next, each piece is placed in a fixture and surface-ground on both sides of the slot. The center line of the slot and the center line of the bore are held to very close tolerances. Ace made the tools and gauges and engineered the entire finishing operations.

This is typical of Ace service and ingenuity from start to finish. Consult Ace on small precision-parts or assemblies calling for stamping, machining, heattreating, or grinding. Send sample, sketch, or blueprint for quotation.



Keep a copy of this booklet in your postwar planning file. It will come in handy.



ACE MANUFACTURING CORPORATION
for Precision Parts



1241 E. ERIE AVE., PHILADELPHIA 24, PA.

Six Colors Proposed For Safety Code

(Continued from page 25)

—high visibility yellow, alert orange, safety green, fire protection red, precaution blue, and traffic white—including gray and black. Wherever feasible, the color code is supplemented with the use of symbols or designs as for example—the triangle or arrow with orange, the cross with the green, the square with red, the disc with blue, and yellow and black with alternate striping. It is recommended that the color code be applied as standard procedure for the following applications:

High Visibility Yellow for use on:
Trucking equipment
Aisle markings around hazards
Edges of loading platforms and pits
Railings
Floor pan edges
Conveyor parts at hazardous levels
Chain hoist blocks
Aisle obstructions
Protruding parts
Curbings
Dead ends
Low beams
Stairway approaches
Floor elevation changes
Loading buckets
Risers of off-standard steps

Alert Orange for use on

Interior surfaces of:
Electrical switch boxes
Fuse boxes
Fuse boxes
Power boxes
Machinery guards

Exposed parts: Pulleys Gears Cutting devices Rollers

Safety Green to identify:

First Aid Rooms Stretchers Cabinets for gas masks Cabinets for respirators Cabinets for medicinal supplies Safety Showers

Fire Protection Red to spot:

Extinguishers Fire hose Hose connections Hydrants Apparatus Fire doors Alarm stations Fire blankets

Precautionary Blue to be used on:

Ovens Vats
Electrical controls Boilers
Valves Compressors
Vaults Kilns
Dryers Tanks
Scaffolding

Traffic White (Gray or Black) for:

Traffic controls
Storage areas
Waste receptacles
Aisle markings
Corners
Floor areas immediately surrounding waste
receptacles

The concepts of good seeing through the use of proper lighting have been incorporated into the du Pont system of "Three-dimensional Seeing" which combines the use of color and light for work placés, assembly lines, and production machinery. This new concept satisfies the two basic requirements—brightness and contrast—to make for strainless full vision which is so essen-



PROTECTS

The tough, resilient, coiled rawhide faces of C/R Hammers and Mallets strike effective blows without battering or marring... protects finished surfaces, machines delicate insulation and parts. Speed die-setting, assembly, no fatiguing re-coil. Reduce breakage and spoilage. Sizes and weights for every need.

C/R Hammers have permonent malleable iron heads which take replaceable insert faces of mechanical rawhide.



BAUER& BLACK Industrial Tape

It takes more than THEORY to make good tape

Sure, theory's important in developing industrial tape . . . but it's got to be backed up by proof when you use the tape.

And right there you have the difference between Bauer & Black Industrial Tape and "just tape."

We start on the theory that the right application of the right tape can help you speed production . . . cut operating costs . . . and do a lot for over-all plant efficiency.

After we know the problems... after survey and research... after the final showdown under severe tests in our laboratory... beyond theory... then we know it is the right tape for the job to be done.

Let Us Help You with Your Problems

Over forty years of developing and producing

many kinds of adhesive tape from fine surgical tape to rugged industrial tape, has taught us many things that may help you.

Out of our laboratory have come major advancements such as the first successful sterilization of tape and . . . the development of tapes to withstand extreme climatic conditions anywhere in the world.

This same tape experience is ready to tackle your problems.

Conservation Service

Our conservation service has saved others from 15% to 40% of their annual tape bills.

Write or call and set a time when our trained sales engineers, working with your own production staff, may survey your plant for specific data on the application of Bauer & Black Industrial Tapes.



A Product of

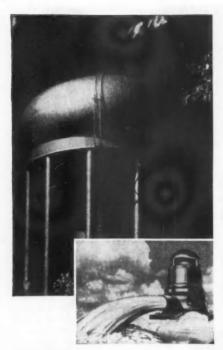
BAUER & BLACK)

Division of The Kendall Company

2500 SOUTH DEARBORN ST., CHICAGO 16, ILLINOIS

IMPROVE METHODS . . .
PRODUCTION SHORT CUTS
TO REDUCE COSTS

RIES



"SWING SHIFT"

And Around the Clock . . .

Time means nothing to a finely engineered, sturdily built and properly installed Layne Well Water System. Throughout the twenty-four hours of each day it must be in perfect—and thoroughly dependable working order. A sudden water failure could bring disaster.

Layne Well Water Systems—thanks to more than sixty years of world-wide experience, are as near failure proof as human skill, manufacturing honesty and quality materials can make mechanical equipment. Even the metals used in contact with the water are varied to assure longer life where corrosive conditions are encountered.

In addition to sturdiness in build and quality of materials used, Layne Well Water Systems and Layne Vertical Turbine Pumps are famous for their high efficiency. Such efficiency effects substantial savings each year.

To get all that you expect and must have in a dependable and long lasting water system, and to eliminate worry of failure, always choose a Layne Well Water System. Fully interacted literature may be obtained by addressing Layne & Bowler, Inc., General Offices, Memphis 8, Tennessee.

AFFILIATED COMPANIES: Layne-Arkannas Co., Stottgart, Ark. * Layne-Arkannic Co. * Norfolk, Va. * Layne-Central Co. * Memphi Free * Layne-Northern Co. * Mishawaka, Ind. * Layne-Loutisiana Co. Lake Charles, La. * Loutisiana Well Co. * Monroe, La. * Layne-Northwest Co. * Milwaukee, Wis. * Layne-Ohlo Co. * Columbus, Ohlo * Layne-Christophi Co. * Columbus, Co. * Layne-Christophi Co. * Columbus, Co. * Columbus, Ohlo * Layne-Creas Co. * Kouston, Texas * Layne-Christophi Co. * Columbus, Ohlo * Columbus,



WELL WATER SYSTEMS
DEEP WELL PUMPS

BUILDERS OF WELL WATER SYSTEMS FOR INDUSTRIES AND MUNICIPALITIES

and
AVIATION
INDUSTRIES
Goes into
Leading
Plants in the
Automotive
and Aircraft
Industries



Six Colors Proposed For Safety Code

(Continued from page 152)

tial in achieving safety, and guarding quality. By painting machinery in colors having high reflection quality, the machines become light reflectors, much to the improvement of quality and safety. Moreover, when the body of a machine is finished in, say, du Pont horizon gray while the working areas are painted in a contrasting hue, danger points are "spotlighted" clearly.

At the present writing, du Pont recommends the use of light gray for the body of the machine, combined with "spotlight buff" or "spotlight green," for contrast. In addition, specific color treatment is advised for walls and ceilings, for work benches, for floors, etc. The proper combination of good light with reflective surroundings—without glare—provides a startling improvement in working conditions and in quality of product.

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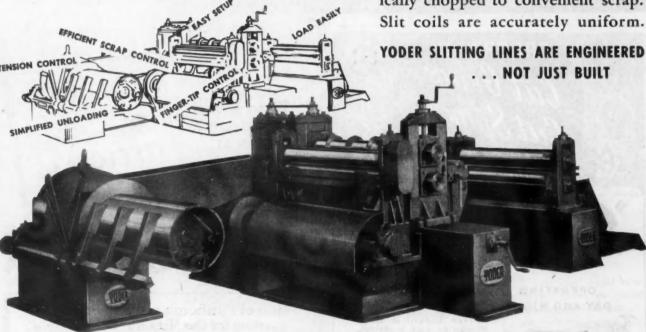
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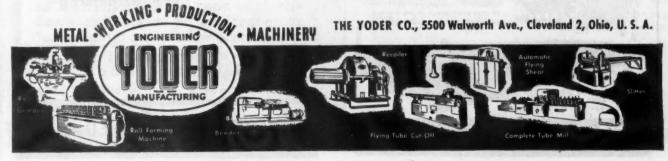
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C-F POSITIONERS



Hupp Acquires Globe Machine & Stamping Co.

Hupp Motor Car Corp. has entered into an agreement to acquire as of June 30 the assets and business of the Globe Machine & Stamping Co., Cleveland. R. S. Geddes, president of Globe, will become president of Hupp when the transaction is completed. The agree-ment was announced by Col. Willard F. Rockwell, board chairman of Hupp.

Globe Machine & Stamping Co., founded in 1902, has been producing ordnance materiel under prime contracts from the government. In peacetime it serves the automotive, refrigeration and air conditioning industries, both through development of its own products and on a subcontracting basis, Hupp is now making brakes, clutches and other automotive and engine parts in war production.

New Name and Location For Photoprint Company

The Photoprint Company, high-speed method for mechanically dplicating lofted drawings is widely used in the aircraft field, has moved its East Coast processing plant from Elizabeth, N. J., to 401 North Broad Street, Philadelphia 8, Penna. At the same time, the name of the firm was changed to the Template Reproduction Company-Division of D. L. Ward Company.





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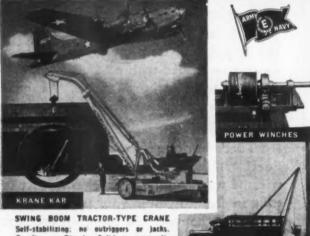


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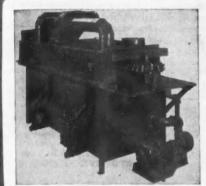
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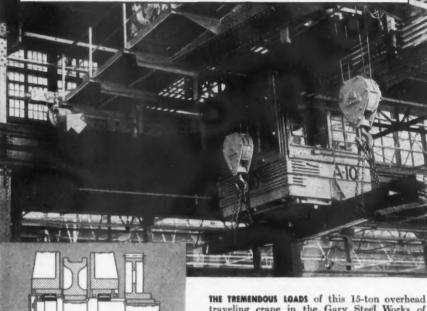
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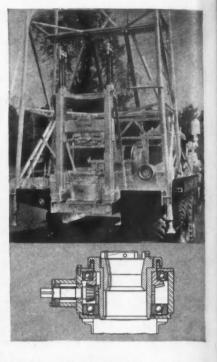
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